THURSDAY, FEBRUARY 15, 1872

THE POSITION OF THE CENTRE OF GRAVITY IN INSECTS

MY researches on the conditions of equilibrium in living beings, have led me to the conclusion that a complete knowledge of them is only possible when the position of the centre of gravity in each is known.

At present the knowledge of the mechanism of the Articulata has made considerable progress, thanks to the use of processes of investigation borrowed from Physics; and it appeared to me, that there would be real utility in the description of an easy method for the discovery of the centre of gravity in the Articulata, and the results which its application to insects has allowed me to obtain. I am, unfortunately, unable in a simple *résumé* to give a description of the instrument which I have employed. A very short description without an engraving is necessarily obscure, and loses all utility. I shall simply say that the instrument in question is a reproduction, on a small scale and with some improvements, of that which Barelli has invented for the determination of the centre of gravity in man. And with regard to the results of my experiments, I must also renounce the idea of giving them in the form they assumed in my work, that is, without the considerable number of figures combined in tables. I shall confine myself to the enunciation of the general conclusions I have been able to deduce, and to supporting them, as required, by several examples.

(1.) The centre of gravity in an insect is situated in the vertical and medial plane which passes along the longitudinal axis of the body.

(2.) It occupies a position almost identical in insects of the same species, the same sex, and in the same attitude.

(3.) The exterior form of the body rarely permits the determination of the exact position of the centre of gravity *without experiment*. I shall cite the results with which the family of Odonates have furnished me as examples. All its representatives have nearly the same exterior aspect; and yet, notwithstanding this *quasi* identity of structure, I have found in the relative position of the centre of gravity the following differences :—

Agrion puella,	female	1st third of the 3rd abdominal ring.
„ sanguinea	„	Posterior border of the 2nd abdominal ring.
Libellula conspurcata	„	„ „ of metathorax.
Libellula vulgata	„	Groove between thorax and abdomen.
Æschna grandis	„	Middle of 2nd abdominal ring.

(4.) The centre of gravity does not occupy the same position in the two sexes of one species. It is sometimes less and sometimes more to the rear in the females than in the males; and its situation depends on the relations existing between the different dimensions of the individuals. One would suppose that the centre of gravity would always be situated further back in females than in males, as the abdomen of the former is in general more bulky than that of the males. During the metamorphosis from larva to perfect insect, the relative centre of gravity approaches the head; the absolute centre, on the contrary, recedes from it.* This apparent contradiction is very easily explained; the thorax of the larva is generally much reduced, and the abdominal rings numerous. In the perfect insect the thorax has acquired considerable dimensions, and the number of abdominal rings has diminished. The thorax, prolonging itself more to the rear, has approached, so to speak, the centre of gravity, which also remains in the medial region of the body; and the abdomen shortening itself, the distance of its extremity from the point in question diminishes.

(5.) While standing, the centre of gravity is placed at the base of the abdomen, or in the posterior portion of the thorax, and usually in the centre of the length of the body.

(6.) When an insect is walking, its centre of gravity undergoes constant displacement about a mean point, but the distances of displacement are too small to be measured. In fact, if experiments are made with leaping Orthoptera, grass-hoppers, or Acridians, it is ascertained that the displacement of their enormous posterior members leads to changes in the situation of the centre of gravity, but these changes are so small that one arrives at the conclusion that it is impossible to measure them in ordinary insects.

(7.) The displacement of the centre of gravity, when the insect passes from the state of repose to that of flight, cannot be ascertained except with those species where the wings lie folded on the back when in a state of repose. The displacement is horizontal and from back to front.

For example, in the following species the displacement is :—

Dytiscus dimidiatus	.	0·045 of the total length of the body.	
Hydrophilus piceus	.	0·028	„ „
Melolontha vulgaris	.	0·053	„ „
Notonecta glauca	.	0·032	„ „
Locusta viridissima	.	0·054	„ „
Vespa vulgaris	.	0·023	„ „
Plusia gamma	.	0·025	„ „
Eristalis tenax	.	0·037	„ „

(8.) During active flight the centre of gravity oscillates continually about a mean position, which corresponds with the instants when the extremities of the wings pass the point of crossing of the 8-shaped curve which they describe in the air.

(9.) In aquatic insects the centre of gravity is nearer to the lower than to the upper surface of the body.

(10.) During swimming, the movements of the posterior feet, acting like oars, determine the oscillation of the centre of gravity around a mean position, which answers to the position of the swimming feet placed at the middle of their course. These oscillations of the centre of gravity lead to a continual swaying of the body about a transverse axis passing through the mean centre of gravity, and it ought, consequently, to follow a gently undulating course.

FELIX PLATEAU

* In my work I have called the relative position of the centre of gravity, its position as regards any portion of the body, as rings, hip *(hanche)*, &c.; and I have named the absolute position of the centre of gravity the number which is obtained by calculating the relation between the distance of the centre of gravity from the posterior extremity of the body and the total length of the animal. The quotients, 0·50, 0·67, for example, obtained in this manner, mean that the distance of the centre of gravity from the posterior extremity is $\frac{1}{10}$ or $\frac{2}{10}$ of the total length of the body. They show immediately, and independently of the form and thinness of the rings, whether the centre of gravity is in the centre of the insect, nearer to the head, or nearer to the anal orifice.

ON THE COLOURING-MATTERS FOUND IN FUNGI

DURING the last autumn I studied very carefully the colouring-matters occurring in such fungi as I was able to find in my own district. For the correct specific determination of many of them I am much inbebted to Mr. M. C. Cooke. Though the number examined was small, compared with the total number of British species, it was sufficient to lead to some interesting conclusions, and at the same time to point out the necessity of the examination of many more, which so far have not fallen under my notice. It therefore appears to me better to postpone the description of the individual colouring-matters until I can include a greater number, and compare them as a whole with those found in algæ, lichens, and other natural orders; but at the same time it may be well to give a short general account of some of the conclusions to which I have been led by the facts already observed.

So far I have been able to determine, by means of their optical and other properties, the existence of at least thirty distinct colouring-matters, and I feel persuaded that further examination will greatly extend the list. The majority of fungi contain at least two, and many contain several, different coloured substances, which can be separated, or perfectly well distinguished by other means. Closely allied species sometimes contain two or more in common, but very often one or more differ; whilst, at the same time, species belonging to somewhat widely separated genera are occasionally coloured by identical substances—for example, *Stereum hirsutum* and *Peziza aurantia*. Notwithstanding this, on the whole, there does appear to be a very decided connection between the general organisation of the plant and the particular kind of colouring-matter developed in it. There is, however, a considerable variation, even in different individuals of the same species—one developes much of one substance, and another of another—and thus we can easily understand why we often find them of very different colours, with every intermediate tint. The connection between general organisation and the coloured products is still more decidedly proved by comparing those met with in fungi with those found in other natural orders. As already mentioned, I have been able to distinguish at least thirty different kinds in fungi. Of these fully twenty have such well-marked optical characters that they could be recognised without difficulty in other plants. Some of the rest could not be easily distinguished when mixed with any of the modifications of tannic acid, and therefore nothing very positive can be said about their presence or absence in certain plants. Confining our attention to those about which there is no such doubt, I may say that only one is known to occur in any plant not a fungus. This is the fine orange colour, soluble in bi-sulphide of carbon, found in *Calocera viscosa*, which agrees perfectly with the more orange-coloured xanthophyll of some faded leaves, and of the exterior layer of the root of the carrot. The rest have hitherto been found only in various fungi. Neglecting individual differences, and taking into consideration only such general characters as are most useful in dividing colouring-matters into natural groups, there is also a remarkable difference between those of fungi and of some other natural orders. In several previous papers I have described how colouring-matters may be divided into three groups by the manner in which they are acted upon by sulphite of soda. In group A the detached absorption is removed, even when the solution contains free ammonia; in group B it is removed only when the solution contains excess of a weak acid, whilst group C is not changed in either case. So far, with only two exceptions, all the colouring-matters found in fungi belong to group C, even when they are blue or red, whereas with only two exceptions all the blue and red colouring-matters in the petals and leaves of flowering plants belong to groups A and B. A larger proportion of those of group C occurs in fruits, and a still larger in coloured woods, and thus the colouring-matters of fungi are much more closely related to those in woods than to those in flowers or leaves. As far as my observations extend, there is little or no specific agreement between the substances found in fungi and those in algæ and lichens. These latter orders are, however, closely related in this respect, for the greater part of the specific colouring-matters found in algæ occur in lichens, along with others similar to, but perhaps not identical with, those met with in fungi. Substances analogous to tannic acid are not of common occurrence, but are found in a few, as for example in *Agaricus sublateritius*, passing by oxidisation into a very insoluble brown colouring-matter, as in the case of faded leaves in autumn.

I am most willing to admit that much still remains to be learned; but, at the same time, these various facts appear to prove that there is some definite relation between the organisation of plants and the chemical and optical characters of the compounds formed during their growth. If further research should establish this conclusion, one may perhaps indulge the hope that it will throw much light on certain questions in vegetable physiology.

H. C. SORBY.

SCHMIDT'S COMPARATIVE ANATOMY

Handbuch der Vergleichenden Anatomie. Eduard Oscar Schmidt. Sechste Auflage. (Jena, 1872.) Pp. 402.

IT is now more than twenty years since the first edition of this manual appeared. The plan is that of a companion to the author's lectures as Professor in the University of Gratz. It begins with a somewhat lengthy introduction on the general principles of Morphology and Physiology. In discussing the distinction between animals and plants, the author appositely quotes Buffon's dictum, "Il n'y a aucune différence absolument essentielle et générale entre les animaux et les végétaux." He also does full justice to the pre-eminent importance of Cuvier's labours in palæontology as well as in comparative anatomy and classification; but it is strange to find the name of Hunter conspicuous by its absence, even in a brief sketch of scientific biology. The lines which the author has chosen for the motto of his book,

> Alle Gestalten sind ähnlich, und keine gleichet der andern,
> Und so deutet der Chor auf ein geheimes Gesetz,

have, he believes, now received their solution. For Prof. Oscar Schmidt is a convert to the Darwinian creed. He says, "I have not freed myself from my old geological orthodoxy without much difficulty; and I am therefore

pleased to have finished this new edition, in which the breach is complete." The contents of the book show that this is no half-hearted conversion.

It is divided into chapters, each of which treats of the anatomy of one of the primary groups of the animal kingdom, and the following table of contents, not given in the work itself, sufficiently indicates the principles on which the arrangement is made. 1, Protista and Protozoa; 2, Cœlenterata; 3, Echinodermata; 4, Vermes; 5, Arthropoda; 6, Mollusca; 7, Tunicata; 8, Vertebrata. There is a good account of the Tunicata, or "Primeval Vertebrates" (Urwirbelthiere), from which the following is an extract.

After describing the characters of the ascidian larva as known before Kowalevsky's researches, the author continues:

"When the yelk-division has taken place, the ovum becomes first flat and then hollow on one side. A depression is thus formed, lined by two layers of cells (germinal laminæ). From the more superficial of these are developed the skin and nervous system, from the deeper the notochord, muscles, and alimentary canal, the muscles arising in a secondary layer of cells derived from the deeper original one. A dorsal groove bounded by two longitudinal folds becomes rapidly converted into a tube, the spinal canal, and this is immediately followed by formation of the tadpole-like tail. . . . The primitive digestive tract is the depression described above, which first closes and then forms a new opening on to the surface, the future mouth. The branchial sack, alimentary canal, and cloaca keep pace with the other organs (those, namely, which are derived from the superficial or serous layer), and when the larva becomes fixed, the latter either disappear altogether, like the notochord, or undergo retrograde change, like the nervous system. Thus the original likeness of the larva to the vertebrate type becomes lost."

Each chapter begins with a pretty full survey of the classes, orders, and other sub-divisions in the group of which it treats, with their several characters. In looking through these, some points appear worthy of note. No mention is made of Gregarinida. Sponges are kept among the Protozoa. The account of this class is not so full as might have been expected from the author's familiarity with it; and with respect to its relation to the Cœlenterata, he merely remarks: "The early form of calcareous sponges, as well as the adult condition of certain genera, suggest a comparison with the Cœlenterate type." The Tunicata are removed from the worms, but Infusoria are added to this heterogeneous group, which, with Prof. Schmidt and most German naturalists, includes Bryozoa and Annulata, and probably contains as many distinct types as it did when Linnæus first defined it. Among the Arthropoda, *Limulus* is placed between the Amphipoda and Branchiopoda, as the type of the Crustacean order Pœcilopoda, while the Myriopoda do not appear at all. The Pteropoda form an order of the Gasteropoda, or (as they are inconveniently called) Cephalophora. The Vertebrata are divided into seven classes, *Amphioxus* and the Cyclostomi being both separated from Pisces, and made into independent primary divisions. Dipnoi appear as the highest order of fishes, separated from the Ganoids by Teleostei. Among the monodelphous mammals it is surprising to see the Sirenia still united in the same order with the true Cetacea; while, on the other hand, the Pinnipedia are separated from the other Carnivora. The order Primates is broken up by the exclusion of *Homo* altogether, and the separation of the Lemurs (Prosimiæ). The author agrees with Haeckel and Gegenbaur in regarding this last order as the lowest of the Discophorous Mammalia, and as representing the ancestors of that group.

The morphological description in each of the above chapters embraces in most cases too wide a subject for the space allotted to it. Even in Gegenbaur's work one finds the Vertebrata, and still more the Vermes, too extensive for the anatomy of the whole group to be conveniently considered at one view, and, not only is Schmidt's style less concise, but is not illustrated by diagrams of any sort. The account of the vertebrate skull and of the specialisation of the somites of Arthropoda are instances of the deficiency referred to. Moreover, there is generally much too cursory an account of Embryology in comparison with other subjects. Indeed the development of Vertebrata is entirely omitted. The bibliography is evidently intended as a guide for students to the latest and most accurate works in each department, and for that purpose is fairly complete and well selected; but there are some remarkable omissions, as of Mr. Parker's monograph on the shoulder girdle.

On the whole, this expanded syllabus is interesting, as a fresh instance of the progress which "the new zoology" is making abroad; but its chief practical value will probably be to those who have the advantage of hearing the author's lectures. For them the wish with which he sends out the present edition will no doubt be amply fulfilled: "I hope that it will remain what it has been, a book for students, and will keep me in that active intercourse with young minds which ensures to a university teacher the freshness of thought, the imagination and openness to new ideas, which he can so ill afford to lose."

P. H. Pye Smith

OUR BOOK SHELF

Text-Books of Science. Technical Arithmetic and Mensuration. By Charles W. Merrifield, F.R.S. (Longmans and Co.)

Arithmetic is a science as well as an art, and although the title of this book points solely to the art of arithmetic, we are bound to examine how far it has supported its right to a place in the series of text-books of science. The author says in the preface that "his experience has led him to believe that there is not much practical connection between successful teaching and logical sequence. The province of logic is to test ideas, not to impart them." We venture to demur entirely to these propositions, and to assert that each successive idea acquired by the pupil should be made to follow logically from the ideas previously existing in the mind, and that ideas which cannot stand the test of logic are, in an educational point of view, worthless.

We proceed to select a few instances of the disregard of logical sequence which the author considers compatible with successful teaching. (1.) The only definition of division given is the following:—"The object of division is to find how many times one number is contained in another. This number of times is called the quotient." A few pages further on is given the method of dividing *l. s. d.* by 365, and no hint is given that a different interpretation of division is required, viz., distribution of the

money into so many parts, and not finding how many times the number 365 is contained in so much money, which is meaningless. (2.) Multiplication is said to be only a shorter method of "getting at" a particular kind of summation; but when we come to fractions we are told parenthetically that to multiply 7 pence by $\frac{3}{4}$ is to take three-quarters of it, without any discussion of the extension of the very meaning of the word multiplication that must be made before this interpretation is intelligible. In the same way we are told that one way of writing $289 \div 17$ is $\frac{289}{17}$ before the important truth has been impressed on the pupil that $\frac{1}{4}$ of $3 = \frac{3}{4}$ of 1, so that a symbol is used in two distinct senses before the identity of those senses has been shown. Throughout the book all difficulties are slurred over with half reasons, which are to be accepted by the pupil as whole ones. There is no attempt to lead the pupil to discover the rules for himself, or to trace the way in which they were originally arrived at; while at every turn we meet with such expressions as "evidently," "it is clear," "it is easy to see," "there is no mystery about decimals," as substitutes for the considerations which should really connect the new rules with the previous knowledge of the pupil. We might pick out specimens of this want of thoroughness from almost every page, but we must now turn to the art of arithmetic. The author says "care has been taken not to introduce anything in the way of mathematical invention or discovery," but surely care should also have been taken that the book should not be behind those already published in the brevity and completeness of the methods given. The rule for contracted multiplication is given, but its application to complicated calculations, such as practice, interest, stocks, &c., is left untouched. Contracted division is mentioned, but is not applied to the only case where it is indispensable, division by an interminable decimal. Decimalisation of money is taught, but by the old clumsy method; while a mode of approximate decimalisation is given, which is of no use if the result required be greater than the given amount. The latter portion of the book is devoted to mensuration, in which considerations that belong to the higher mathematics are described as evident, while all mention of the mensuration of rectangles and the difference between linear, square, and cubic feet is omitted. The book is below the level of the more advanced thought of the age, and unworthy to take rank in the series which contains "Miller's Inorganic Chemistry," and "Maxwell's Theory of Heat." H. A. N.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

The Total Eclipse as seen at Ootacamund

As a photographer and an ardent lover of science, I was of course anxious to catch an image or two of the eclipse, as a memorial of the grand scene of the morning of the 12th inst. Unfortunately for me, I read a short time ago an article by Mr. Brothers, of Manchester, on photographing eclipses, in which he says that it is useless to attempt a photograph of an eclipse without an equatorial stand to fix the camera to. Inquiries soon convinced me that in a primitive place like this it was impossible to get such a stand, and, in consequence, I gave up all idea of making an attempt at taking a photograph of the eclipse. The eclipse, however, no sooner commenced, than I laid aside my telescope and brought my camera into use to watch the progress of the eclipse, with the aid of a strong magnifying glass on the focusing screen of the camera. Here I saw that the progressive movement was scarcely perceptible; and that, with a short exposure of three seconds, I might get an image: though not perfectly sharp, yet it might show all details necessary for forming an interesting memorial of the eclipse.

I prepared one plate some time before totality, washed it, so that it would keep good for an hour or so, and some time after totality had commenced I exposed it for three seconds, and developed it some time after totality. As far as I know I exposed the plate 75 seconds after the commencement of totality, and the result was the plate I had the pleasure to hand to you, and the prints you saw in my place were printed from it. I may add that the plate was taken with a No. 6 D. Dallmeyer's lens, with the full opening and without a stop.

I will digress for a moment and express my surprise that I hear that the photographers of the Expedition parties obtained only five or six plates during totality, and that they gave exposures of about 15 seconds. If I had exposed my plate 15 seconds instead of three, I should have had nothing remaining but "a foggy ghost." There must have been a great want of proper balance in their chemicals. Again, they seem to have been provided with a number of slides, or camera-backs, to hold a certain number of prepared plates. Now, had I known that I could obtain tolerable results without an equatorial stand, I would have presented you with a plate of at least eighteen different photos of totality. As my idea may be useful on a future occasion, I will shortly mention it. Photographers are in the habit of taking 2, 4, 6, or even eight cartes de visite photos on one single plate, and often also with one lens only, by an arrangement which we call repeating backs. A slight modification of the repeating back would have enabled me, or any one else, to take in quick succession, without loss of a second, at least 18 or 20 photos of the eclipse on one single plate. Different exposures might have been given to some or to all, and a treble number of photos to what has been obtained might have been secured without additional expense, and with less trouble. Any apparatus-maker would furnish such a slide for about 40*s*., and as the operator would have only to pay attention to one slide and one plate, he would work with more certainty and comfort. If any one will say that one good photo of the eclipse was all that was needed, I must say that I differ from him. I observed most distinctly that the shape of the corona was undergoing a regular dissolving view process, and had not for two seconds exactly the same shape. Of this more hereafter.

The eventful day commenced here in the centre of Ooty, with the sky overcast both in the east and west with dark grey clouds. The camp of the Expedition on Dadabetta appeared enveloped in fog, so that the early prospects of the members stationed there must have been rather gloomy. In the town where I was the eclipse was visible from the very first commencement to the last moment; only once, for a few seconds, during the earliest stage, a small cloud obscured the sun. The grey, gloomy clouds receded (as if inspired with fear) as the eclipse advanced, in the direction of all four points of the compass, and the atmosphere between the earth and the sun and moon appeared of that absolute pure and blue hue, which can seldom be seen anywhere else except in high mountains. The scene as seen from the centre of Ooty was a grand sight. Every eye was turned to the east, the curious play of colours around the hidden sun, the general gloom or want of light, the ghostly shadows thrown by trees and other objects, the clear appearance of the stars in the west, combined with the solemn stillness (which we enjoyed at Ooty) not a breath nor a leaf moving, combined with all the other novelties of a total eclipse, formed a scene which is easier imagined than described. Chickens and fowls were of opinion that the day was ended, and retreated to their roosts, and many old people (natives of course) hid themselves in their huts, filled with anxious expectations of the things which were to come. The whole scene was still more enhanced by a large assembly of natives which had assembled near my place. Their exclamations of fear, of terror, and awe, were very amusing if not distracting. Now their fear showed itself by short and earnest incantations or prayers to a certain good deity to deliver the sun from the cruel fate of being swallowed by the large serpent, which, in their opinion, constantly pursues the sun, and overtakes it during an eclipse, and when only the interference of a good deity can save the sun from the fearful fate of having to undergo digestion in the belly of the terrible serpent. Some began to smite their breasts, and pluck their hair, accompanying these acts with exclamations which betrayed no small amount of mental agony about the probable fate of Father Sol; others watched in trembling silence, awaiting the end with fear, but coupled with hopes that the prophecies of the holy Brahmin might yet be fulfilled. Higher and higher rose the excitement, until the entire sun was engulphed in the terrible serpent's mouth. But it happened, as the Brahmins had foretold, a powerful good deity cut off with one blow the big serpent's head, and the sun, instead of going

down the serpent's throat, emerged slowly in all his glory from the opposite side.

If science gains as much in knowledge by the observations made by the different eclipse parties as the wily Brahmins have gained by this late eclipse in money, then a great deal of knowledge will have been gained about all those mysterious phenomena by which Father Sol is still surrounded; for every village in India, as far as the country was affected by the eclipse, paid willing contributions to the Brahmins, that these holy men might use all their influence (by prayers, fastings, and offerings) with their deities in order to induce them to come to the rescue of the sun in the hour of his great danger and need; and I hear that the Brahmins hereabouts had an abundant harvest in money from the poor villagers, to whom they preached months before the great danger impending over the sun; and as these poor people are not yet bold enough to doubt a single word of these heaven-born Brahmins, they contributed to the best of their abilities to the Brahmins, in whose hands, as they believe, rests not only the fate of men but of the whole universe, as the Brahmins are the connecting links between men and the deities ruling this and other worlds. An event like the eclipse shows how much importance is to be attached to all the reports and writings about the great progress in enlightenment of the people of India. Knowledge does not reform their manners; many well-informed and educated natives performed all the superstitious ceremonies connected with the eclipse, with just as much zeal as the ignorant ryot, and many of those who talk to us Europeans about the folly of all the old superstitions, went back again, and performed their rites in the manner of their forefathers, fearing, that if they did not do so, Father Sol might be lost for good, and that we might have to end our remaining days in the constant gloom of starlight.

I have already mentioned that, as far as my observations go, I observed that the shape or form of the corona or glory which surrounded the eclipsed sun underwent changes in form even during the short space of two minutes; but you will easily see that an observer with no other means than an ordinary good telescope, his naked eye, and a photographic camera, was quite incompetent to draw any conclusion; suffice it therefore to say that the changes in the shape of the corona during totality can but be compared to the slow transformation of forms in a dissolving-view apparatus, or perhaps more correctly to the changes of form and shape we observe in isolated thin clouds. I will not express more of my opinion on the nature of the corona than that I believe it consists or partakes of the nature of shining, illuminated ether, perhaps somewhat of the same nature as the aurora borealis; why I think so will appear below.

About eight or ten seconds before totality ended, the moon appeared as if it had made a jerk (stumbled against something), and that jerk was accompanied by a tremendous flickering movement and momentary brightening up of the corona. This momentary phenomenon (for all passed in less or not more than one second) I am unable to describe more clearly, and I cannot compare it to anything except to those flickering movements and brightenings up observable in the aurora borealis. I spent one entire night during the winter of 1845 in watching a grand aurora borealis in North Germany, but had nearly forgotten all about it, but the above appearance in the corona towards the close of totality reminded me so forcibly of it that I hold that something similar is connected with the corona. I was watching the eclipse with a strong magnifier in the camera obscura, and three gentlemen near me used telescopes, and we all observed the same—I in the camera, and they with their telescopes—and the flickering caused us all to express some surprise, such as "Look! look!"

In the evening I had some conversation on the eclipse in general with the telegraph master, a very scientific gentleman, who, without my saying anything about the matter, told me that he observed such a phenomenon.

I think this is about all I can say, as the play and changes of colours which were visible are quite beyond my sphere; I can only say I saw them, but I do not remember their order and succession, nor changes.

In conclusion I must once more repeat that what I say must be taken for what it may be worth. I merely speak of the appearances without accounting, or being able to account, for them; and this will not be surprising when those who spend their lives in these studies can often only offer conjectures as to the real nature of these matters.

Ootacamund, Dec. 22, 1871 J. BOESINGER

Natural Science at Oxford

THE regulations relating to Natural Science at Oxford, reprinted in a recent number of NATURE,* will have considerable interest for those who follow the progress of such studies at the Universities.

The Natural Science School is one of the five "Final Schools." There are examinations which take place at the end of the University course; in any one or more of them it is open to candidates to seek for honours. Hitherto the Natural Science School has offered a threefold division of its subjects, namely, Biology, Physics, and Chemistry. A candidate was allowed to select any of these three divisions, and was expected to show, in the first place, a general acquaintance with the subject matter; and in the second, a detailed knowledge of some particular branch of it. The selection of the "special subject" was left entirely to the candidate, but the liberty of choice (in theory a most valuable one) was frequently altogether abused. The object was, apparently, in many cases, to turn the tables on the examiners, and by selecting matters likely to be out of the way of their reading, to make the examination almost fictitious. It is to remedy this that the new Board of Studies has laid down the scope of the general and special knowledge which will be required from candidates for the future.

The regulations at present published relate only to Biology. I venture to think that they by no means form such a philosophically-arranged course as might have been expected.

The first paragraph states the nature of the *general* knowledge which will be demanded. This is defined to consist of General and Comparative Anatomy, Human and Comparative Physiology and Physiological Chemistry, and the general philosophy of the subject. The books recommended are the best commentary on the meaning attached to these headings. The list certainly does not err from defect of copiousness, yet it is noticeable that although it contains all the common zoological text books, it does not include any distinctively botanical book whatever. I do not mean to say that some of the authors named in it do not touch on Botany, but this is so far accidental that they apparently owe their position on the list to their bearing on zoological matters. It appears to me therefore that the only conclusion which can be arrived at from the regulations is that by Biology is not intended General Biology, but only Biology from a zoological standpoint. This is, I think, to be regretted. A general acquaintance with the principal forms of vegetable life ought to form part of a comprehensive biological course, and should be required even of those who intend to devote their strength to the study of the animal economy alone.

The fifth paragraph appears to admit of Botany being taken up to a certain extent as an alternative subject, but this does not remedy its practical absence from the general scheme. I can see nothing in the regulations to preclude a candidate taking high honours in "Biology" who shall, for example, be quite ignorant of the anatomical differences between a cycad and a palm, or shall be quite unable to indicate any points of agreement between a mushroom and a mould. Any one in this predicament might perhaps excuse himself as a zoologist, but he can hardly be allowed to claim the whole of Biology as his province.

W. T. THISELTON DYER

Auroral Statistics

HAVING had already to answer many questions and calm some fears touching the recent brilliant aurora, and its prototype in October 1870, "when the Franco-German war was raging," I beg to send you some condensed statistical returns of auroral phenomena during the last eleven years, prepared and printed before the recent manifestation, and to be published in a few days, but as a part of a ponderous volume not likely to be generally accessible, viz., vol. xiii. of the "Edinburgh Astronomical Observations."

In that book I have endeavoured, amongst other subjects of professional duty, to exhibit the final mean results of nearly 7,025,000 meteorological observations of all kinds, by 55 observers of the Scottish Meteorological Society, spread over the country at as many stations; and, after a preliminary process of compression into 32 numerical tables, the quintessence of the whole appears on a single page, whereof the 28th line gives a numerical expression for each month of the year; combining the

* See NATURE, No. 118, p. 270.

number of times that aurora was visible with the extent of country over which it was observed, and the numbers stand thus :—

January	...	...	29·7
February	...	...	42·5
March ...	...	...	35·0
April ...	...	...	27·5
May ...	...	...	4·8
June ...	...	...	0·0
July ...	...	...	0·5
August	...	...	12·6
September	...	...	36·0
October	...	...	49·4
November	...	...	32·4
December	...	...	28·8

It will thus be seen that October and February are precisely the two months when brilliant auroras are most likely to be seen ; and that of these two maxima of the annual cycle October has rather the advantage.

The lightning return, prepared on the same principle, is not uninstructive to be compared against the aurora ; for, though both in its aërial altitude and actual numerical returns, lightning may be the very opposite of aurora, yet it exhibits a tendency to a similar double maximum in the course of the year ; and not a few of the lightning storms of that second, or winter maximum, are locomotive "meteors," travelling from S.W. to N.E., and having undoubtedly a very wide-spread earth-influence and physical signification. The actual numbers are these :—

January	...	...	24·0
February	...	...	14·4
March ...	...	...	7·0
April ...	...	...	15·4
May ...	...	...	37·4
June ...	...	...	48·0
July ...	...	...	53·2
August	...	...	38·4
September	...	...	22·4
October	...	...	20·8
November	...	...	15·0
December	...	...	15·0

C. Piazzi Smyth

15, Royal Terrace, Edinburgh, Feb. 10

The Aurora of February 4

I will not attempt to describe the wonderfully gorgeous display of aurora which I witnessed on Sunday night, February 4. I merely wish to mention a circumstance connected with it which may have some interest. I was watching for the zodiacal light at about 5.30, and, having perceived faint traces of it, I presently saw some peculiar red clouds a little above it ; from their rapid change of form I soon became aware that this was the light of an aurora. From that time, and from that spot, it spread rapidly ; a bright white arch extending high overhead from W. to E., while a segment of blue sky stretched low down in the

S.E. in the magnetic meridian, the space between being filled with brilliant colours. Shortly after this a radiating point became very striking, not in the zenith, but at one-third the distance from the Pleiades to Capella ; and then the folds of gorgeous light-red, white, and faint green, interspersed with dark shading, spread from it, like a canopy, down on all sides except in the N.W. I never witnessed or read of such a display in these latitudes. With one of Browning's small star spectroscopes the spectrum consisted of a small portion of brilliant red, then a bright band rather close to it, and then two others beyond ; the two latter being rather nearer together than the first and second ; that at the more refrangible end being the faintest, and that near the red the strongest. I enclose a sketch showing the spectrum, the slit being wide open.

The maximum display was between 6.45 and 7 P.M ; at 7.15 it was fading rapidly. Clouds covered the sky at 7.30, and some smart electric showers fell ; still I could see that the display was going on ; and at 11 P.M., in spite of dense clouds, the light was sufficient to enable me to read large print.

Henry Cooper Key

Stretton Rectory, Hereford, Feb. 6

On Sunday evening 4th inst., a beautiful display of aurora was observed here (lat. 51° 26′ 0″ N., long. 0° 20′ 53″ W.). My attention was first directed to it at 6h. 4m. (G.M.T.) at which time there was a fiery glow over a considerable portion of the southern sky, much resembling the reflection of a distant conflagration. Shortly after, an almost complete auroral arch, of faint orange red light, similar to that at first observed, was noticed, extending from E., above and partly embracing δ, ϵ, and ζ Orionis, to W., its altitude (by estimation) at the centre being about 40°, and its extent something like 120°. For a short time this glow was most intense in S.S.E. at a great altitude, but the display attained its greatest intensity about 6h. 15m., when a number of rays or streamers of whitish blue and orange red light appeared as if radiating from a point near δ, α, and κ Persei. At 6h. 20m. nothing was observed but a widely diffused fiery glow, which must have continued more or less during the whole evening, as it was again observed by me at 8h. 25m.

John James Hall

Fulwell, near Twickenham

There was a fine display of the above phenomenon here on Sunday night, February 4. At five o'clock a muddy undefined redness made its appearance in the N.E. and W., especially in the former, which continued for some time without any very marked change. Towards half-past six the redness became more concentrated, gradually brightened, and finally became of a most intense brilliancy—indeed, so much so that it fairly baffles description, the landscape and the countenances of those standing near being visibly tinged. Streamers soon began to form, and shoot gradually upwards from the horizon in all directions from N.E. by S. to W., some intensely red, some very white, while others were of a greenish hue. The red and white being very brilliant, were finely intermingled, especially in a N.E. direction, while a muddy green prevailed chiefly in the S., and a reddish tinge in the W. By seven o'clock that rare phenomenon, a corona, was formed overhead, assuming a variety of shapes. The most curious part of the display (as far as my experience goes) was the entire absence up to this time of any streamers or coloured haze in a W. by N. to N.E. direction, the sky being cloudless, perfectly clear, and the stars shining with their usual brightness. On the formation of the corona a sheet of fan-shaped sea-green haze shot from it in a N. direction, spreading rapidly as it advanced, but did not proceed for more than 20°, when it suddenly disappeared. The streamers were remarkably steady throughout and straight, unlike those during the display of November 10 of last year, which were wave-like, rapid, and flickering. By half-past seven the entire sky had assumed a greenish tinge, with a reddish glow in some places, and a few resplendent beams of white light from the E. chiefly. At a quarter to eight red streamers became visible in a N. direction, at a considerable elevation, resting on a greenish haze, itself emanating from a very indistinctly white arch spread across the N. At nine the sky was still tinged, and a streamer here and there visible, but by ten the display was over, as clouds had obscured the heavens. Although the red colours were so intense and deep, the stars could be distinctly seen through them, and when the streamers suddenly changed to white, &c., it was possible to see the time on a watch, though the night under ordinary circumstances would have been dark. A common dipping needle which marked 56° at noon changed to 45° before the aurora became visible. Barometer corrected and reduced, 29 748. Temperature, 37° at the time. Solar radiator during the day, 77°. A few shooting stars darted across the heavens in a south from east direction, mainly during the aurora. A wet night afterwards set in.

Thomas Fawcett

Blencowe School, Cumberland, Feb. 5

A VIEW of the magnificent aurora of Feb. 4 was much interrupted here by great masses of cloud, which frequently drifted over large tracts of the illuminated sky, and towards 8 o'clock collected and descended in a general downpour of rain. Nevertheless enough of it was seen to produce a very striking impression. It began to tinge the southern sky at a considerable altitude so early in the evening that I thought it must have been the reflection of a crimson sunset; nor was I undeceived till I had been to the other side of the house, where I found the western horizon glowing with amber light, in which was no trace of the expected ruddiness. Red continued throughout to be the prevailing hue, chiefly in great diffused masses, but occasionally broken up into filaments and streamers; there was, however, no absence of sheets and columns of the more usual pale green light. The clouds, chiefly heavy cumuli, assumed a strange aspect; sometimes, when opposite to the crimson illumination, reflecting a dull and sombre red, at others, when projected in front of it and enlightened from the other side by the twilight, or the green aurora, standing out in lurid and ghastly contrast. At one period the northern part of the sky, up to a great altitude, though clear and studded with stars, appeared at first sight almost like a black cloud from its contrast to the greenish white sheet which bordered it abruptly at a considerable height on the west; this again passing into crimson masses in the south, and sending out a whitish stream to meet another from the east, and form, probably, for a few moments, a complete bright ring, somewhat south of the zenith, of which, however, only one half could be seen from the post of observation. The light was so intense that even after it had been a good deal obscured by cloud, a large print might have been read without much difficulty. A miniature spectroscope (one of Browning's) brought out some interesting features. The usual yellowish green auroral line was distinct everywhere, and could be perceived even when the instrument was directed to masses of dense cloud; and as was observed by Birmingham on a former occasion, could be made out in the reflection from any suitable terrestrial object; white paper for example exhibited it very obviously. As shown in the brighter greenish patches in the sky, it remained visible even when the slit was so much contracted that the sodium band of a common fire would have been thinned down almost to its smallest breadth before extinction. Such a diminution of light, however, was fatal to the rest of the spectrum, which was a very remarkable one. With a wider slit a crimson band, bearing a fair amount of contraction, was perceptible in the brighter patches of that hue, with a dark interval between it and the principal green band. On the opposite side of that green band, beyond a second similar dark space, was a considerable extent of greenish or bluish light, quite decided, but so feeble as to leave it undecided whether it was of uniform brightness, or (as I suspected) compounded of contiguous bands; beyond this again was another dark space, leading on to a faintly luminous band, too dim to show colour, but which must have taken its place somewhere in the blue. This band, and the darkness adjacent to it on the less refrangible side, were each about as broad as the intensely vivid yellowish green stripe. Could the light have borne sufficient reduction, we should certainly have had three narrow bright bands in the red, green, and blue, the two latter being wide apart, with either a faint separate continuous spectrum, through part of the interval, or possibly several feeble lines, which the widening of the slit fused into one lengthened area.

The peculiarity, first noted I believe by Otto Struve, was very obvious, that even where the naked eye recognised the strongest and fullest crimson without a trace of green, the greenish yellow band in the spectroscope far exceeded, perhaps three or four times, the red line in visibility. This display was distinguished from almost all that I can recollect to have witnessed through many years, by its very feeble development in all the northern portion of the sky.

Hardwick Vicarage, Hay T. W. WEBB

WILL you kindly permit me to correct an error which crept into my letter of last Monday on the aurora. The words "western" and "north-eastern" in the 14th line should have read respectively "eastern" and "north-western." Allow me also to call attention to the present condition of Jupiter. On Thursday evening last the equatorial ochre-tinted belt was lighter in colour than I have seen it of late years, but much and distinctly mottled with light and dark clouding, two dark hanging spots on the upper edge, with adjoining elliptical bright patches, being conspicuous, while the lower dark madder-brown edge was very unequal, being swollen and thick about one-third to the right from the centre, and thinning off towards each end. The dark belt above the equatorial zone had two knots or thickenings of considerable size upon it, and the whole series of belts presented ragged and dentated edges, and, to use the apt phrase of a lady who saw them, had a "mountainous" look.

On occasional glimpses I more than suspected a general mottling of the whole surface of the planet, which, moreover, presented a dull appearance, the dark and light belts and spaces not being, as I thought, so well contrasted as usual. The poles were coloured as in ordinary, the upper one warm and ochreish, the lower slate grey. The instrument used was Browning's 8¼ reflector, full aperture, with inserting achromatic eye-piece 306. A transit of a satellite and its shadow added to the general effect.

Guildown, Guildford, Feb. 10 J. R. CAPRON

ON Sunday, the 4th of February, at 10 P.M., I observed the central point of the "corona" of the aurora visible that evening to be situated between ι, 64 and 65 Geminorum, in R.A. 7h. 20m. and N. decl. 28°. Our latitude is N. 50° 50′ 55″, and longitude E. 0° 32′ 50″.

The "corona" drifted away very slowly towards the E. against a slight E. wind blowing at the time.

Perhaps some of your contributors can calculate the aurora's height from the earth from the above notes, and let us know the result through your journal. J. E. H. P.

St. Leonard's, Sussex, Feb. 12

NOT wishing to trouble you with a long description of the aurora observed by so many on the evening of the 4th, I will confine myself to a few remarks. The spectrum of the brighter portions, viewed through a five-prism direct instrument, consisted generally of the four lines mentioned by Captain Maclear; but when the spectroscope was turned towards the brightest of the curved streamers forming that splendid red and pink star, which so suddenly burst forth at 7·25, some degrees south of the zenith, the relative intensity of the lines was completely changed, the red line becoming more strongly marked even than the green.

The fact that the green line can always be detected, even where the unassisted eye fails to notice any trace of auroral light, might suggest the advisability of a daily observation with a small hand spectroscope for those who are desirous of forming a complete list of all auroral phenomena. Magnetic disturbances are a sure guide in the case of grand manifestations of aurora; but might not a very slight aurora be observable without the magnets being sensibly affected?

On the evening of the 4th the magnetic storm commenced about 2 P.M., and was at its height from 4 to 9, though the magnets were not steady again until after sunrise the next morning. S. J. PERRY

Stonyhurst Observatory

I WRITE a very short account of the great aurora of February 4, as seen by me in the south-east of France, between Chambéry and Macon. It may be of some interest, as a brilliant aurora is very unusual in those latitudes, and this was quite comparable in brilliancy to the auroras of October 1870, and November 1871, which I witnessed in Scotland. The sunset was very clear and bright, but as the sunlight gradually faded, light fleecy clouds appeared in different parts of the sky, with the ruddy tints characteristic of the Northern Lights. As it became darker the redness increased in intensity and extent, overspreading a large portion of the sky, especially towards the zenith, and was streaked with bands of greenish white light. On the eastern horizon a well-defined arch of this pale green light was visible for some time, while underneath the arch the sky was so black that but for a large star shining in the centre of the blackness, I should have supposed that the darkness was due to a heavy cloud. There were, in fact, no true clouds at the time in the sky, and the large stars were everywhere visible amid the shifting masses of nebulous light, which at one instant seemed to be the ruddy reflection of a great fire, and at another to be lighted up by the rays of a full moon. Long streamers of red and green light seemed to shoot up towards the zenith from almost every point of the horizon at various times; but singularly enough there appeared to be fewer displays of this sort in the north than in any other quarter of the heavens. Being, however, in a railway carriage in motion,

and with mountains on every side, the true horizon was not visible, and it was impossible to make very accurate observations. The rosy clouds remained long after the coruscations had died away, but the chief splendour was displayed for an hour and a half after sunset.

If the aurora of this spring was not more brilliant than those of the last two autumns, it was, I think, more remarkable for its sharp contrasts of colour, and for the peculiar "coal-sacks," or areas of blackness, which seemed to be actually a part of the aurora as much as the red or green light.

DAVID WEDDERBURN

I HAVE to correct an important error in my account of the aurora of the 4th, published by you on the 8th. I stated that it was finest between 6 and 7. At 9 it appeared to be fading, and I ceased to watch it; but I learned afterwards that it re-kindled, and was at its highest between 9 and 10. The colour was still red, and the columns of light met near the zenith.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, Feb. 12

The Great Comet of 1861

THE following observation may interest your readers. It is taken from a volume entitled, "The Industrial Progress of New South Wales," published by authority of the Colonial Government. Under the head of Astronomical Progress is a paper by Mr. Tebbutt, in which he says that, while observing in Australia on the morning of July 1, 1861 (*i. e.*, really, in the afternoon before sunset of our June 30), he noticed the widening out of the branches of the tail of the comet then visible. He remarks that this observation is very interesting when taken in connection with the announcement made by Mr. Hind, that "it appears not only possible, but even probable, that in the course of June 30, 1861, the earth passed through the tail of the comet, at a distance of perhaps two thirds of its length from the nucleus."

There were at least two observers in England of what was probably the opposite effect of perspective (viz., the closing up of the branches of the tail) on the evening of June 30. The rapid, angular motion of one of the streamers was separately observed by Mr. George Williams, of Liverpool, and the Rev. T. W. Webb, of Hardwick, the latter of whom has given a detailed account of his observations in the "Monthly Notices of the Royal Astronomical Society," vol. xxii., p. 311. According to these observations, our actual passage through the streamers of the tail must have taken place about sunset on the evening of June 30.

A. C. RANYARD

ON LUMINOUS MATTER IN THE ATMOSPHERE

MUCH has lately been written and lectured on atoms, molecules, organic matter suspended in the air, effects of the light passing through the sky, abstracting its blue colour, and changing it into red. May I therefore be allowed to add some facts which I noticed during a long and careful observation of a hitherto almost unknown phenomenon to which my attention was drawn by chance.

Some years ago I had directed my excellent six-feet of Merz, Munich, towards the sun in order to draw the sun-spots in the camera-obscura. One day (April 27, 1863), when the sun had scarcely passed, and I was pushing the instrument to get its disc again in the field, I was astonished to perceive a mass of luminous little bodies, apparently coming from the sun, and passing altogether with great velocity towards the east. They brightened in a white and sparkling light, and were as numerous as stars; but as their velocity was much too great, and as they disappeared when I followed them to some distance from the sun, I was inclined to take them for little bodies floating in the atmosphere, and getting their light from the sun, an opinion which soon became stronger when I grew aware that I had to draw out the eye-piece some millimetres in order to get them quite clear and distinct. As I had never heard of the existence of any such bodies, I resolved to give notice to Dr. Wolf, Director of the Observatory at Zurich, who convinced himself of the strange phenomenon, and, encouraging me to persist in my investigations, told me that the late Sig. Capocci, on the Capodimonte Observatory at Naples, had mentioned these little bodies appearing to him under similar circumstances on May 11, 1845. Since that time Prof. Dr. Edward Heis, of Münster, Westphalia, in his "Wochenschrift fur Astronomie," 1869, March 24, also gave full corroboration to this fact. I therefore went on, and uniting the investigation to the daily labour of observing and drawing the sun-spots, my arrangement of the camera-obscura improved and ensured these results as well. Convinced of the importance of the phenomenon, I resolved to direct my whole attention to it, and to examine it thoroughly. I decided to find out not only the distance, the size, the shape, the frequency, the velocity, and the nature of the light of these little bodies, but also to take notice of their daily direction by comparing it with the simultaneous direction of winds and clouds. I continued my observations during a period of three years.

As I mentioned above, I was obliged to draw out the eye-piece of the telescope in order to have the little objects more distinct. Now, everybody knows that the focal distance of any lens, or system of lenses, such as the telescope is, will differ according to whether the beams come from a more or less distant object. The little bodies did not appear distinct in the focus of the sun; I had to draw out the eye-piece; but if the focal distance was greater, their distance was smaller than that of the sun, and by means of a scale placed on the eye-piece, I soon obtained the result that these little bodies belong to our atmosphere, floating in a stratum of about 4,000 metres down to about 200 metres, the most numerous swarm passing almost always at a distance of not less than 500 metres. Here I remark that for my observations I had chosen the time of the sun being in, or about, the meridian, for then I was sure to have its light as strong, and the sky as clear as possible, while mostly preferring a magnifying power of only 48 diameters.

Taking the little bodies in the right focus, I was enabled not only to draw their shape, which I found very various, but also to measure their apparent diameter, which did not differ less, and depended much on distance, the nearer ones being larger, and, as I learned from the scale the accurate distance of every one, I calculated their diameter to vary from 10 to 59 millimetres, the average being 32 millimetres. Their shape was very various, too. The greater number were oblong, angular, resembling flakes, some few were orbicular, while some smaller ones were star-shaped, with transparent arms.

With respect to their frequency, I was surprised to find on certain days, especially in April and May, an incalculable number of little bodies in the field of the instrument, passing without interruption for hours. In general I found their number to be connected with the purity of the sky; and every day I noticed the average, the daily minimum occurring in the morning and evening hours, the maximum in the noon-tide hours; also the annual minimums in the summer and winter months, the chief maximum from April 20th to May 15th, the second, much lower maximum in August and September. I often saw their number increase soon after clouds had passed.

The velocity of the bodies, irregular in the lower strata, being about 2 metres in a second, became greater and more regular in the higher ones, where, for instance, at a distance of 3,000 metres, I found them to pass 8 metres during the same period, a rapidity agreeing closely with that of the *cirri*, which often passed at or above this distance. Whether far or near, all these little bodies glittered in a magnificent white light behind the sky, but as it retreated farther from the sun its blue colour became darker, the light of the bodies consequently diminished, and was

more and more absorbed, when I followed them to some five or more degrees from the sun, in whose proximity they always brightened most, but passing over its disc, appeared to be rather dark, changing, however, suddenly into white when they emerged and entered the blue again. It became obvious that the little bodies I had before me were of small density, partly opaque, apparently of a white and reflecting surface, the edges of which were lit up by the sunbeams.

The course of the higher ones (at some 1,000 metres distance) being generally parallel, and their reciprocal velocity of about the same rate, I noticed much variety in the lower strata, where their flight was often of great inconstancy, changing their direction every moment, or falling, and second after second augmenting their focal distance, by the change of which, taken on the eye-piece scale, I learned that these bodies did not quite follow the law of gravitation, losing time; a fact not surprising to me, already convinced of their small consistency. In comparing the daily direction with the simultaneous course of winds and clouds, there was a remarkable conformity. Accepting the direction of the clouds to be the same as that of the wind in the stratum they pass through, a supposition not far from the truth, to which, of course, I was forced, having no weather-cock in such high regions, I found the direction of the little bodies and the clouds (in about the same stratum) to be (1) accurately the same in 31 per cent.; (2) differing not above 90 degrees in 49 per cent.; (3) differing not above 180 degrees in 67 per cent.; and (4) of quite opposite direction in only 1½ per cent. This conformity is so evident that when the sky is cloudless, starting from the distance and direction of the ever-passing little bodies, one might easily learn the direction and perhaps the velocity of winds in the reciprocal strata, a fact of course of no little value to meteorologists and even mariners.

Taken altogether, these results could not but lead to the opinion that what I had to deal with were ice-crystals and flakes of snow. Here it may be recollected that already, in the seventeenth century, Mariotte, the renowned discoverer of the law of gas-expansion, pointed out that parhelions and mock-moons are caused by ice-crystals floating in the sky; and indeed, if we consider the above results, we are forced to believe him. Firstly, we learned that these bodies belong to the atmosphere; we also found them in its lower strata. Their average size of 32 millimetres, their flake-like shape, their incalculable number, will also strongly convince us. But while the minimum during the winter months might seem rather unaccountable, the chief maximum occurring in April and May, it may be remarked that from September to March the sun, although in the meridian, does not light up so strongly the rather misty sky; and that many days the sun will not appear at all. Now, referring to the chief maximum, from about April 20 to May 15, is it not astonishing that it occurs on the very same days which, especially those of May, were at all times well known from their low temperature, and called in Germany "the Latins" (Pancratius, May 12; Servatius, May 13, &c.), and were much feared by gardeners? But are the enormous masses of ice-crystals found in the atmosphere during these days the origin of its low temperature, or does the latter favour the formation of snow-masses? I only mention the fact that, for instance, heat is absorbed when snow is melting, and would be happy to direct the attention of meteorologists in any country to this phenomenon, inviting contributions of facts and correspondence. Finally, the velocity of the bodies being the same as that of the clouds, their reflected magnificent white light, their regular courses in the higher regions where strong winds are generally blowing, their irregular or even falling movement and small density in the lower ones, and their very remarkable conformity of direction with simultaneously passing clouds, will give much support to my explanation.

HENRY WALDNER

Weinheim, near Heidelberg

THE MONGOOSE AND THE COBRA

IN reading the interesting account of a fight between these two animals, as given in NATURE for Jan. 11 (p. 204), the question arises, How does the mongoose survive the bite of the cobra? There are only two solutions of this question, viz.:—(1) That the mongoose has some antidote; and (2) that it is not affected by the cobra poison. With regard to the first, various observers give different antidotes, such as grass, *Aristolochia*, &c. (see Sir J. E. Tennent's "Natural History of Ceylon," p. 38). There is no *one* plant that the mongoose has been *proved* to go to as a remedy. 2. That the mongoose is not poisoned by the bite of the cobra has, I think, been proved by Dr. Fayrer, of Calcutta. I quote three of his experiments, which are published in the *Edinburgh Medical Journal*, April 1869, pp. 917-919:—"A young mongoose (*Herpestes Malacconsis*) was bitten two or three times by a full-grown cobra, at 1.24 P.M. on the 30th April 1868, on the inner side of the thigh from which the hair was first removed. Blood was drawn by the bites." This animal died in six minutes, but in the two following experiments no harm resulted to the mongoose. The second mongoose was also "bitten on the inner side of the thigh, and put into a cage immediately." It got no antidote except "raw meat," and was none the worse for the bite. The third mongoose was put into a large wire cage with a full-sized cobra at 1 P.M. (April 2, 1868). "The snake struck at the mongoose, and they grappled with each other frequently, and apparently the mongoose must have been bitten, as the snake held on to it about the neck or head. At 1.15 P.M. there was no effect on the mongoose; both it and the snake were much excited and angry, the snake hissing violently. 2.30; no effect on the mongoose. The snake is bitten about the head, and shows the bleeding wounds. 2.51; they are both occasionally darting at each other, but the mongoose jumps over the snake, and tries to avoid it. Next day at noon both were well; the snake frequently struck at the mongoose, but did not appear to injure it; both seemed very savage, but the mongoose would not bite the snake; he jumped over it. There had been two cobras in the cage during the night, both equally fierce, and striking each other and the mongoose; but the latter was uninjured. He was bitten once by the cobra rather severely on the head."

JAMES W. EDMONDS

HARTWIG'S SUBTERRANEAN WORLD *

THE increasing demand for works of a semi-scientific character similar to that now under consideration, is in itself the most satisfactory proof that a desire for acquiring a more extended and accurate knowledge of the phenomena of Nature is gradually taking root within a

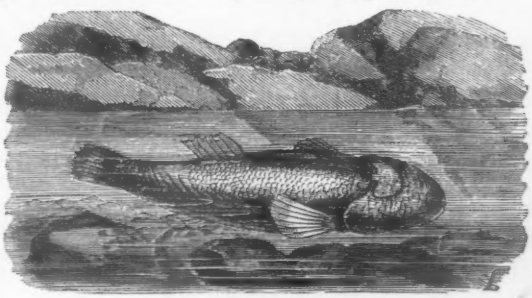


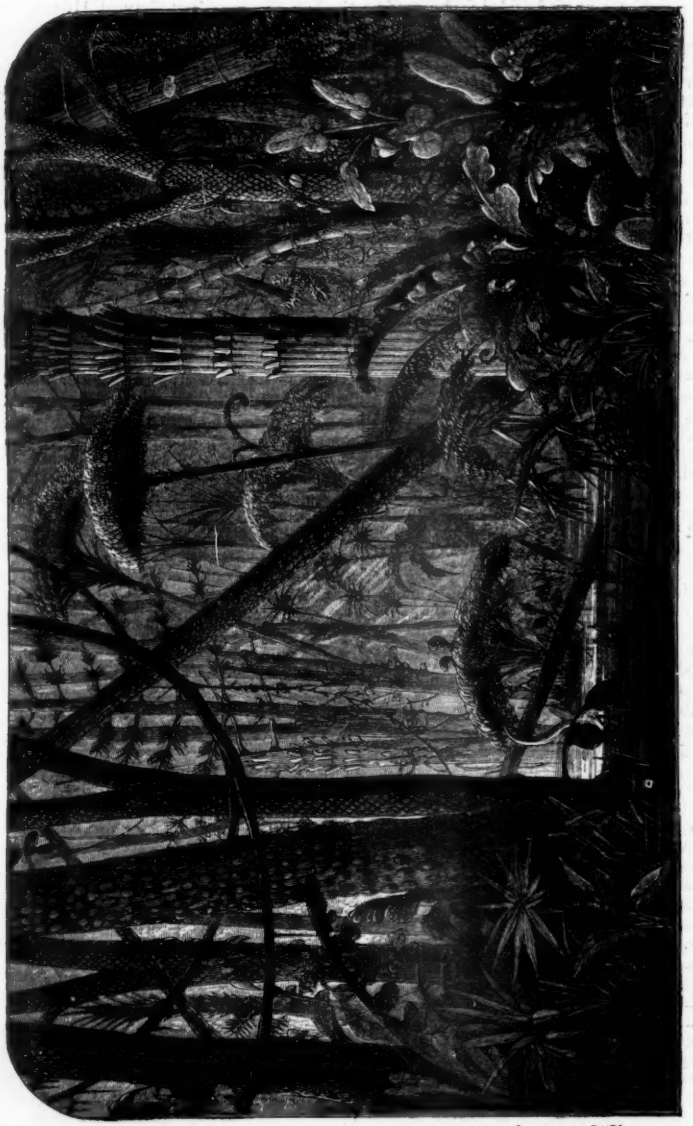
FIG. 1.—Blind Fish (*Amblyopsis spelæus*)

class of society, which, until of comparatively late years, had always contented itself with a very opposite style of literature. When it is observed, in many of the so-called popular scientific books, that accuracy has evidently been less

* "The Subterranean World." By Dr. George Hartwig. (London: Longmans, Green, and Co.)

carefully studied than what is termed sensational effect—a feature so characteristic of the period we live in—it is refreshing to find that Dr. Hartwig, in his description of the various phenomena of the subterranean world, has, without any such aid, succeeded admirably in conveying a vast amount of solid information, in so lucid and easy a style as to make even his unscientific readers quite interested, and likely to forget that he is treating of subjects usually considered as pertaining to the domain of dry Science. In so doing he seems also to have been assisted by having adopted a system of classification, or rather grouping, of the subjects which form his separate chapters, which, although not strictly scientific, is preferable in the present instance, as being more in accordance with popular notions.

The work, besides being well got up, is abundantly



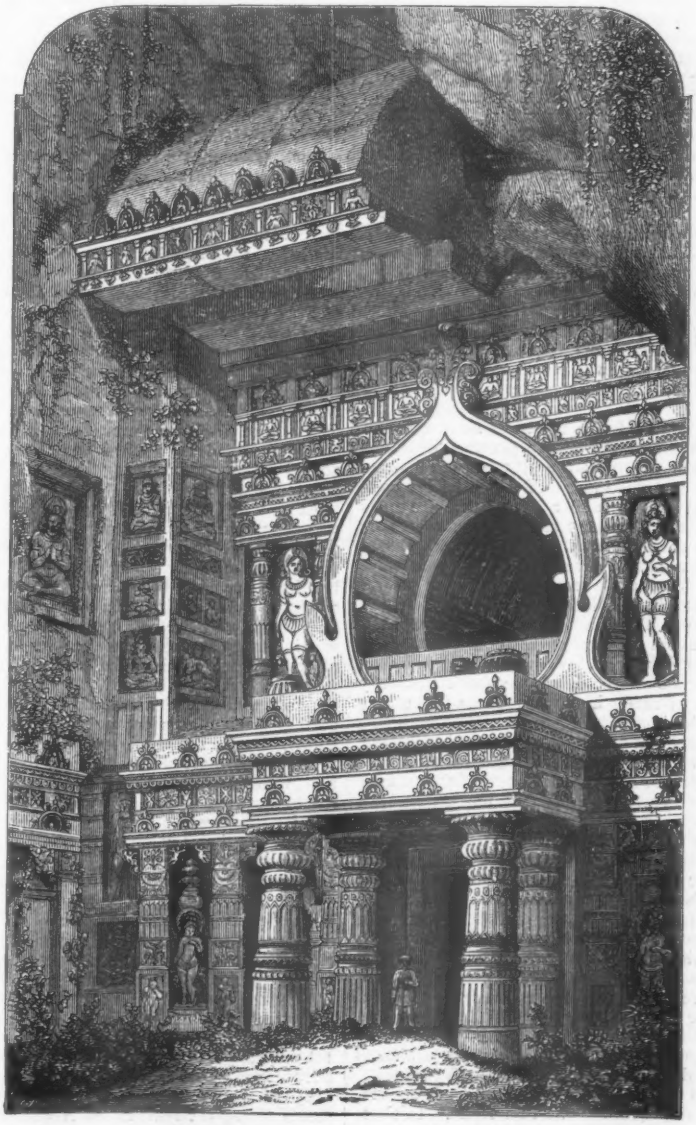
CARBONIFEROUS FOREST, CARBONIFEROUS PERIOD

illustrated; many of the woodcuts being of very superior character and execution, whilst the plates are, in general, good, and with one exception—that of the ideal view of the great earthquake at Lisbon in 1775—they are free from that objectionable sensational or exaggerated character so observable in the illustrations of French works on popular Science, several of which have lately been rendered into English. The two maps indicating the distribution of coal and metallic deposits in Great Britain and the Americas respectively are not on a par with the rest, owing to errors of omission; thus, amongst others, neither the central lead-producing district of Wales, nor

the Northampton iron district, are shown in the former; nor have the auriferous deposits of Central America or British Columbia been indicated on the latter map.

In a work intended for the general British public, the temperature, when alluded to, should preferably have been stated in degrees of Fahrenheit's thermometer, since, although the scale of Celsius or centigrade is often made use of by men of science here, it will not be at all familiar to the majority of the readers of Dr. Hartwig's book, which it is to be hoped will have a very extended circulation. Several errors in the text might also be pointed out—as, for example, calling the usual Cornish ore or copper pyrites a bisulphuret of copper; titanium is stated to be a metal of a copper red colour, &c.; but when the great extent of scientific ground over which the author travels in this book is taken into consideration, some allowance must be made, and it must fairly be admitted that the work, as a whole, is singularly free from serious errors, and we would recommend it strongly, in the belief that from its at once easy entertaining and instructive style, it will be sure to interest many in the study of these natural phenomena, to whom the very name of Science is at present associated with all that is dry and uninviting.

D. F.



INDIAN ROCK-CUT TEMPLE: PORCH OF THE CHAITYA CAVE TEMPLE, AJUNTA

RECENT DISCOVERY OF PIT-DWELLINGS

DURING the late summer, while engaged in excavating a Roman building at Finkley, near Andover, a deep trench, 100 feet in length, was found, dilating at the opposite ends into large subterranean pits, which, from the primitive character of the articles met with in them, such as flint and bone implements, spindle-whorls of chalk, and a rude form of pottery, appeared to belong to an earlier period than the Roman. One of the labourers engaged in the explorations became quite an expert in the recognition of these rude objects; and he having lately been employed in digging a yard at a new railway station, situated on a hill, about half a mile distant from St. Mary Bourne, immediately overlooking the Upper Test Valley, found the subsoil so abundant in calcined stones, broken pottery, and other evidences of early occupation, that he called my attention to the circumstance, which led to the discovery of a group of pit-dwellings or hut-circles; and it is likely, from their mode of arrangement, that they form a portion of an extensive settlement or *vicus*. Some knowledge of nine of these has been obtained, although, from their situation, two only have been completely investigated, and five others partially.

The pits occupy the space of about a quarter of an acre, and have all entrance shafts, sloping gradually downwards from their inlets, and widening as they approach the pits. They may, with their contents, be described *seriatim*. No. 1 is oval or pear-shaped, having its entrance southwards. Its length is 22 feet from the end of the pit to the mouth of the alley; greatest diameter 12 feet; depth at the centre of the pit 5 feet. This was the only circle that contained flints, of which twelve cart-loads were removed from it; and as some of the stones were arranged in courses, without mortar, around its circumference and on each side of the alley, I have thought that the superstructure must have been of flint, and had fallen in. The relics found were chiefly at the centre, where the fire-place had evidently been; the smoke most likely escaping through the centre of the roof. They consisted of about a bushel of calcined flints, bones of a small species of *Bos*, probably *longifrons*, *Cervus elephus*, *Capra*, *Sus*, and *Canis*, besides broken vessels, chiefly of a very rude, hand-made kind, although a few pieces found about the pits bore wheel-marks. The bones had mostly been split open in order to obtain their marrow. They had further been exposed to fire, and bear impressions made by teeth and knives; and some of the smaller long bones had evidently been used as marrow-spoons, while other small splinters of bone had the appearance of having served the purpose of awls or needles. In this circle also part of a rude sandstone hand grain-rubber was found, besides some flint-flakes, a scraper, and some cores; and, in addition, the outer lip of a large cowry, which had been carefully cut from the shell, and had been used as a rasp, the crenulations in the lip being considerably worn down. It had further been employed as a polisher apparently, the enamel being worn away in places.

Pits 2 and 3 were only partially explored, as they extended beneath the station yard. One of them, however, was partly filled with calcined flints; and in it were found a piece of a grain-rubber and pottery and bones similar to those just described.

Pits 4 and 5 had only portions of their passages opened, as the pits extended beneath the Station Road. In these we found a few flint-flakes, and some calcined stones.

Pit 6 contained no remains, as it was evidently the passage only of a pit partly formed, and had not been occupied.

In digging a well in the station garden similar relics were thrown out, and it is evident that the shaft of the well passed through one of these pits; and, as additional evidence of British occupation, in clearing away the soil around the circles, one of the labourers picked up a Gaulish gold coin, which bears on its obverse and reverse degraded representations of more perfect figures. The coin, in short, is a slightly more perfect copy of the lowermost of the three coins depicted at p. 84 of "The Celt, the Roman, and the Saxon," 1st. ed.; which figure is there stated as being a rude copy of a gold stater of Philip of Macedon.

Pit 7 was fully explored. It was 42 ft. in length from the extremity of the pit to the mouth of the passage, which opened eastward; its widest diameter 13 ft. 6 in., and depth 5 ft. at the pit's centre. Here the fire-place had stood, as in No. 1, and around it we found bones similar to those discovered in Pit 1, with the addition of some teeth of a small species of horse, and bones of the hare or rabbit. The bones were, in most cases, broken, and some of them had been wrought for use as implements. Two flint arrow-heads were found in the alley, and the centre of the circle further contained flint-flakes, scrapers, cores, and arrow-heads, a fragment of a rude grain-rubber, and a flint muller showing use on one side. Here also occurred a whetstone, made from a piece of sandstone such as I have observed occurring in the drift of the Reading beds; and evidently from the same drift a lump of native ironstone, containing a large percentage of iron, which had been picked up by some occupant of the pit and used as a hammer. As throwing some small light on their domestic economy, a chalk spindle-whorl was found, and with it a small disc of pottery, bored at the centre, the direction of the hole showing that it had been suspended by a string, perhaps round its owner's neck. The whole of the fictile ware found here was of a rude hand-made type, and some of the "crocks" were scored with irregular zigzag lines, made apparently with a pointed stick.

At nine feet south of Pit 7 a circular hole in the chalk was cleared out. It was found to be 5 ft. in diameter and 3 ft. in depth. It contained a quantity of bones of animals similar to those already enumerated, with snail shells that had been exposed to fire; and beneath the bones a number of charred flints, with charcoal and ashes. It was evident that strong fire had been employed here, as the chalk was in places burnt through and discoloured to the depth of several inches, which led to the inference, coupled with its contiguity to Pit 7, that it was a cooking-hole. It is not unusual for uncivilised people, as the negroes, to have their cooking places outside their dwellings (see "Flint Chips," by E. T. Stevens, p. 59).

At another part of the same yard, about 10 ft. of well-built wall was removed. It was doubtless Roman, as near it a better kind of pottery was found, including a piece of Samian, besides two roof-nails and a bronze buckle.

The quantity of calcined stones everywhere present was the most striking feature in the remains. Some of them, I observed, were faced on one side, and a few had facets at right angles, and these, it occurred to me, might have been used in constructing ovens or fire-places. A large number, however, were perfectly circular, and had bright, clean surfaces; these might have been employed for the purpose of stone-boiling.

With traces of Roman occupation we have here these rude remains which show residence by an earlier people, who, doubtless, lived on after the advent of the Romans. I have, as yet, observed no entrenchments in the field; but there is no doubt that similar circles occupy a large space of the upper slope of the valley. The flint implements stamp the remains as Neolithic; and those found in the pits differ in no respect from the wrought flints occupying the subsoil of the yard, as well as occasionally occurring on the surface of the adjoining fields. The settlement is favourably situated to have enabled the occupants to obtain water from the river Test; and along the same side of the valley, within the space of two miles, I have discovered more than one working site, in which I have obtained a large and varied collection of tools and weapons both chipped and polished.

These huts must have been covered, some, perhaps, with stones, others with a wooden or wattle superstructure, covered with clay or sods of turf; and their poor inhabitants evidently cultivated, to a small extent, some of the cereals, had an early knowledge of weaving, and lived domesticated with oxen, goats, and swine. The red-deer were most likely obtained by hunting in the dense forest that then occupied the deep clay lands of North Hampshire, as an extension of the ancient forests of Harewood, and Chute, and Finkley. Further, these shallow pits might have been the summer residences of a people whose winter habitations were at Finkley.

J. STEVENS

INAUGURATION OF THE OBSERVATORY AT CORDOBA

AN interesting account of the inauguration of the Argentine Observatory at Cordoba in October last appears in the *Standard* of Buenos Ayres. The chief feature of the ceremonial was a very able address by Prof. Gould, the Director, from which we make the following extracts, as bearing specially on the work of the observatory :—

"In the year 1751 a French astronomer, the Abbé de la Caille, visited the Cape of Good Hope for the purpose of determining the positions of the principal southern stars. With a little telescope of comparatively insignificant dimensions, he succeeded in obtaining the materials for so complete a catalogue—as far as the limit of brightness which his telescope permitted—and in determining the positions of those stars so well, that this catalogue of about 9,800 stars constitutes to-day the chief reliance of astronomers for their knowledge of a large portion of the southern sky. Since that time a permanent observatory has been established by the British Government at the same place, and a large number of valuable observations have been made by various eminent men. Other observatories in the southern hemisphere have been founded at Paramatta, Santiago de Chile, and Melbourne, all of which have contributed essentially to our knowledge of the southern sky; as also has the observatory at Madras, which, although north of the equator, commands a view of the greater portion of the southern heavens. Yet how much remains to be done in this direction will be very evident when I state that, while the number of stars in the northern hemisphere whose positions and magnitudes have been determined cannot fall short of about 330,000, the number in the southern hemisphere whose observed places have been published does not probably exceed 50,000. But this is not all. The greater portion of those which have been observed lie in that part of the sky which is clearly visible in Europe; and if we consider the regions beyond 30°, there are scarcely 13,000 southern stars whose places and magnitudes have been determined and made available for scientific use, while the corresponding portion of the northern sky contains something like 164,000 such stars.

"The first undertaking now proposed for the Argentine Observatory is to do something towards filling this hiatus by determining the places of the principal stars situated between the tropics, where the observations of northern astronomers begin to become less numerous, and the polar circle, where Gilliss' observations commence. This work is best performed by dividing the sky into narrow zones or belts, and subjecting each zone to a special scrutiny for the purpose of measuring the positions of all stars of a sufficient brightness within its limits. If no unforeseen impediment presents itself, these observations should be completed within two years from their commencement.

"There is another most important investigation especially desirable in the present condition of our knowledge: this is the application of the newly-discovered methods of stellar photography to the more prominent objects in the southern heavens. The ingenious researches and inventions of Mr. Rutherford in New York have resulted in the development of methods by which the relative positions of clusters of stars may be permanently recorded by photographing them upon glass, and the numerical values subsequently determined by means of a measurement of the photographic impressions, with a degree of precision far greater than that of the ordinary methods. And this process possesses the signal and peculiar advantage, that the representations thus obtained of the stars' places at a given moment may be preserved, and the measurements repeated at any subsequent time. The process has not yet been introduced into European observatories, but it has been thoroughly tested in America, and valuable researches have already been made by this photographic method.

"During the greater part of the year we have had neither instruments nor building, and during the short time these have been available we have experienced an unexpected and most serious obstacle in the clouds of impalpable dust, which, rising from all sides, penetrate to the inmost crevices of every part of the instruments. This difficulty will, I think, be obviated to a great extent when vegetable growth shall have covered the soil; and to this end the Minister has given directions for providing as good a supply of water as may be possible, while the building and instruments have been provided with special and unusual protections against the evil. The position of the city of Cordoba renders this trouble inevitable, inasmuch as water for irrigation is only to be found in the valley, whilst an observatory must necessarily be placed upon high land. With the arrival of the rainy season I trust that a carpet of vegetation may remove this source of anxiety.

"A considerable time would, under any circumstances, have been requisite for computing the numerical table, and making the various other calculations needful for bringing the instruments into active service. The additional interval has been employed in an undertaking of a totally different sort, which may, I trust, be found in the end to possess as much scientific importance as the work originally intended. During this period of enforced delay we have succeeded in making a full catalogue of all those stars of the southern heavens which are visible to the naked eye, determining for each one the precise degree of its brightness. When, after the moon has set to-night, you raise your vision to the starry sky, and, as you look more intently, perceive one faint star after another reveal itself to your sight, you will yet succeed in discerning no star whose place and magnitude has not been recorded within the past year by some one or more of the observers in this institution—

"'Sidera cuncta notans tacito labentia cœlo.'

"The progress of the work so far has not failed to afford its due share of discoveries. It has given us the knowledge of a considerable number of stars which possess the singular character that their brightness is not always the same, but undergoes systematic variations. Some have been seen to rise to considerable brilliancy, and then fade away until telescopes of some power are needed for rendering them visible. Others still are now found to possess a brilliancy decidedly greater or decidedly less than that which has been assigned to them by more than one astronomer in times past. Such stars must be carefully watched, and the fact of any regular and periodic fluctuation in the amount of their light either established or disproved. Of such cases there are already many on our records, thanks to the assiduity and zeal of the assistant astronomers, no one of whom has failed to make manifest the existence of several. One of those most remarkable for the rapidity of its changes is a little star in the constellation "Musea," which is invisible to the unaided

sight during one half its period, and visible during the other half; while the observations of Mr. Rock show that it goes through all its changes within the short interval of $21\frac{1}{4}$ hours. Another in the constellation of the "Southern Triangle," which has been regularly observed by Mr. Davis, exhibits regular fluctuations of light, comprised within a period of about $3\frac{1}{2}$ days, similarly alternating between visibility and invisibility. These two exhibit the most rapid changes of any of the stars which we have hitherto observed; but there are others not less interesting, observed not only by the two gentlemen mentioned, but also by Messrs. Thorne and Hathaway, who are likewise pursuing these investigations with much success."

NOTES

THE retirement of Prof. Huxley from the London School Board throws a great responsibility upon the men of Science in London in general, and on Marylebone in particular. We are of opinion that of all the good work which Prof. Huxley has done, none will have a more lasting national importance than that which has resulted in the introduction of Science among the subjects to be taught in the London schools—and, therefore, in all the School-Board-schools throughout the country, for the force of public opinion will, in the long run, insist that the London model shall be everywhere followed. It is because we fear that this important advance may be arrested, unless steps are taken still to have the claims of Science represented on the Board, that we draw attention to the subject, which, in our opinion, is of sufficient importance to occupy the attention of the Royal Society, and the other scientific bodies, if their aid is necessary. Doubtless membership of the School Board involves sacrifice; but it is to be hoped that the clerical squabbles which have so interfered with the desired progress here, as it did, ineffectually, in other countries, are now as nearly over as they ever will be; and if this be so, then, instead of the 170 sittings given by some members last year, a much smaller number will suffice.

WE have reason to know that many weak people have been alarmed, and many still weaker people made positively ill, by an announcement which has appeared in almost all the newspapers, to the effect that Prof. Plantamour, of Geneva, has discovered a comet of immense size, which is to "collide," as our American friends would say, with our planet on the 12th of August next. We fear that there is no foundation whatever for the rumour. In the present state of science nothing could be more acceptable than the appearance of a good large comet, and the nearer it comes to us the better, for the spectroscope has a long account to settle with the whole genus, which up to this present time has fairly eluded our grasp. But it is not too much to suppose that the laymen in these matters might imagine that discovery would be too dearly bought by the ruin of our planet. Doubtless, if such ruin were possible, or indeed probable—but let us discuss this point. Kepler, who was wont to say that there are as many comets in the sky as fishes in the ocean, has had his opinion endorsed in later times by Arago, who has estimated the number of these bodies which traverse the solar system as 17,500,000. But what follows from this? Surely that comets are very harmless bodies or the planetary system, the earth included, would have suffered from them long before this, even if we do not admit that the earth is as old as geologists would make it. But this is not all. It is well known that some among their number which have withal put on a very portentous appearance are merely the celestial equivalents of our terrestrial "wind-bags"—brought down to their proper level they would have shrunk into very small dimensions indeed. But there is more comfort still. The comet of 1770 positively got so near to Jupiter that it got entangled among his moons, the diameter of the smallest of which is only some 2,000 miles; but the moons pursued their courses as if nothing had happened, while the comet was so discomfited by the encounter that it returned by another road—*i.e.* astronomically speaking, its orbit was entirely changed. While, last of all, in our correspondence this week, will be found one fact the more in favour of the idea that, in 1861, we actually did pass through a comet. We have a suggestion for those weak people who are still alarmed by these celestial portents, and steadily refuse to acquaint themselves with the most elementary work on Astronomy, which would convince them how groundless their fears are. In India, during the last Eclipse, the priests reaped magnificent harvests from the offerings of the faithful. In England, possibly, it would be considered incorrect to make such offerings to the priest; but let them still be made—to the Royal Astronomical Society. In this way the English Philistine would approach nearer the standard of his less-civilised brother; Science would be benefited, and, doubtless, the omen would be averted—at all events they always have been.

THE Anniversary Meeting of the Royal Astronomical Society was held on Friday last, when the president's address was read. The medal this year has been awarded to Prof. Schiaparelli for his brilliant demonstration of the identity which exists in the elements of the orbits of certain comets and known systems of meteors. Among the obituary notices for the year were those of Sir John Herschel, Prof. De Morgan, and Mr. Babbage.

THE Council of the Geological Society have awarded the Wollaston Medal for the present year to Prof. J. D. Dana, of Yale College, Connecticut, and the balance of the proceeds of the Wollaston Fund to Mr. James Croll, of Edinburgh.

THE Hopkins Prize, which was founded in memory of the late Mr. Hopkins, and is adjudged to the author of the best original memoir, invention, or discovery in connection with Mathematico-physical or Mathematico-experimental Science that may have been published during the three years immediately preceding (who is or has been a member of the University of Cambridge) has been awarded to Prof. J. Clerk Maxwell, F.R.S. The adjudicators were Profs. Stokes, Tait, and Clifton. The fund is vested in the Cambridge Philosophical Society.

WE learn that, in addition to the scholarships for Natural Science at Cambridge, of which a list was given in our number for February 1, King's College offers an exhibition of the value of about 80*l.* per annum. The examination will commence on April 9, will include Physics, Chemistry, and Physiology, with one Classical and one Mathematical paper, and will be open to all candidates under twenty, and to undergraduates of the college in their first and second year. Names must be sent in, before March 10, to the Rev. A. A. Leigh, tutor of the college, from whom further information may be obtained.

PROF. GEORGE ROLLESTON has been elected a Fellow of Merton College, under the ordinance of 1854, which founded the Linacre Professorship of Physiology, and endowed it out of the revenues of this college. Prof. Rolleston graduated in 1850, and was afterwards elected Fellow of Pembroke College. In 1860 he was appointed to the Linacre Professorship of Physiology.

THE Industrial Museum at Edinburgh has lost, by the death of J. Boyd Davies, its zoological director or manager. No one knows what the authorities are going to do, but it is to be hoped they will select a good man, not a talker but a worker. The monetary value of the post is 200*l.* to 250*l.* per annum. The Lectureship on Zoology at the High School is also vacant.

AT a meeting of the Royal Geographical Society held on Monday evening last, the president, Sir H. C. Rawlinson, stated that, three days before, the expedition, consisting of Lieut. Dawson, R.N., Lieut. Henn, R.N., and Mr. Oswald Livingstone, the son of Dr. Livingstone, set sail in the first steamer despatched

from the Thames to Zanzibar direct. The three gentlemen engaged in it had been given every assurance that their undertaking would be assisted at home in every possible way. The subscriptions to the fund for its maintenance amounted to 5,000*l.*, of which upwards of 2,000*l.* was received from London alone; Edinburgh had contributed 350*l.*; and the little town of Hamilton, the native place of Dr. Livingstone, 200*l.*; while the corporation of the City of London had subscribed one hundred guineas, and the leading commercial firms of the City had come forward in an equally liberal manner. The Admiralty has refused to allow Lieut. Dawson his full pay while engaged on the expedition.

THE important article which we are able to give this week, on the Position of the Centre of Gravity in Insects," by M. Felix Plateau, is an abstract of a long memoir by that author, to be found in the "Bibliothèque Universelle, Archives des Sciences Physiques et Naturelles," vol. xliii., for 1872.

THE *Naval and Military Gazette* asserts that the *Challenger*, screw-corvette, will be commissioned early in the summer for a voyage of exploration and research. Some scientific gentlemen will be accommodated on board the vessel, and it is probable that Captain George S. Nares, now serving in the surveying vessel *Shearwater*, in the Red Sea, will be placed in command. The actual places which will be visited have not yet been determined, but it is anticipated that the groups of islands in the Pacific will have special attention bestowed upon them. This movement on the part of the Admiralty is in encouraging contrast to the fact that Arctic voyages have been abandoned to other nations, and to the late refusal of the Lords of the Treasury to grant any assistance whatever to the Livingstone search expedition.

THE following is the list of officers and council of the Royal Microscopical Society elected on the 7th of February:—President—Mr. W. K. Parker, F.R.S. Vice-Presidents—Dr. W. B. Carpenter, F.R.S., Dr. J. E. Gray, F.R.S., Sir John Lubbock, Bart., M.P., F.R.S., Mr. John Millar. Treasurer—Mr. John W. Stephenson. Secretaries—Mr. Henry J. Slack, Mr. Jabez Hogg. Council—Dr. Robert Braithwaite, Mr. John Berney, Mr. Charles Brooke, F.R.S., Mr. T. W. Burr, Dr. W. J. Gray, Dr. Henry Lawson, Mr. Henry Lee, Mr. S. J. M'Intire, Mr. Henry Perigal, Dr. G. W. Royston-Pigott, Mr. Charles Stewart, Mr. T. C. White.

THE International Scientific Series, to be published by Henry S. King and Co., is an indication of a movement of great importance. The series will be published simultaneously in New York by Messrs. D. Appleton and Co., in Paris by M. Germer Baillière, and in Leipzig by Messrs. Brockhaus. The first volume, by Prof. Tyndall, F.R.S., on "The Forms of Water, in Clouds, Rain, Rivers, Ice, and Glaciers," is now in the press, and will be published in March next. Among others already arranged for are Prof. T. H. Huxley, F.R.S., on Bodily Motion and Consciousness; Dr. W. B. Carpenter, F.R.S., on the Principles of Mental Physiology; Sir John Lubbock, Bart., F.R.S., on the Antiquity of Man; Prof. Rudolph Virchow, on Morbid Physiological Action; Prof. Alexander Bain, on Relations of Mind and Body; Prof. Balfour Stewart, F.R.S., on the Conservation of Energy; Mr. Walter Bagehot, on Physics and Politics; Dr. H. Charlton Bastian, F.R.S., on the Brain as an Organ of Mind; Mr. Herbert Spencer, on the Study of Sociology; Prof. William Odling, F.R.S., on the New Chemistry; Prof. W. Thiselton Dyer, on Form and Habit in Flowering Plants; Dr. Edward Smith, F.R.S., on Food and Diets; Prof. W. Clifford, on the First Principles of the Exact Sciences explained to the non-mathematical; Mr. J. N Lockyer, F.R.S., on Spectrum Analysis; Dr. W. Lauder Lindsay, on Mind in the Lower Animals; Dr. J. B. Pettigrew, F.R.S., on Animal Locomotion; Prof. A. C. Ramsay, F.R.S, on Earth Sculpture; Dr. Henry Maudsley, on Responsibility in Disease; Prof. W. Stanley Jevons, on the Logic of Statistics; Prof. Michael Foster, on Protoplasm and the Cell Theory; Rev. M. J. Berkeley, on Fungi: their nature, influences, and uses; Prof. Claude Bernard, on Physical and Metaphysical Phenomena of Life; Prof. A. Quetelet, on Social Physics; Prof. H. Sainte-Claire Deville, Introduction to General Chemistry; Prof. Wurtz, on Atoms and the Atomic Theory; Prof. Quatrefages, on the Negro Races; Prof. Lucaze-Duthiers, on Zoology since Cuvier; Prof. Berthelot, on Chemical Synthesis.

THE death of Dr. Harvey, Professor of Botany in the University of Dublin, arrested the progress of the Flora Capensis shortly after the publication of the third volume had brought the work half-way towards its completion. It is hoped that if the Cape Legislature will accede to Dr. Hooker's request for a renewal of the grant towards the expenses of printing, the remaining volumes may be at once taken in hand. The general supervision will be undertaken by Prof. Thiselton Dyer, who will probably receive assistance in monographing different families from Profs. Lawson and Perceval Wright, Drs. Sonder, Trimen, Masters, and MacNab, and from Messrs. Carruthers, A. W. Bennett, Hiern, Britten, and Baker.

DR. MILLER COUGHTREY is engaged on a long paper on the long-handled combs, Roman, Swiss, bone cave, Mexican, and other forms. It is now in proof for the Proceedings of the Antiquarian Society of Scotland.

WE note the appearance of the first number of a new monthly magazine, "The Earth: a popular magazine on Geology," whose object is "to collate and bring together facts and discoveries bearing on advanced and truthful views of Geology, and to oppose false and current opinions on the subject." Among the fallacies to be exposed are:—"That there has been an evolution of one creature into another," "that vegetable life either preceded or succeeded animal life on the globe," "that granite is a rock of fusion," &c.; and among the truths to be advocated are:—"That the configuration of the earth is a result of the agency of the winds and tides, of volcanic action, and of fluviatile and glacial action," "that there has been no evolution of species," and "that basalt is a crystallisation from solutions."

WE are glad to see that the labours of the English Strasburg Library Committee, consisting of Mr. Hepworth Dixon, Lord Houghton, Prof. Huxley, Lord Lytton, the Duke of Manchester, Sir J. G. Tollemache Sinclair, Bart. M.P., and Mr. Trübner, secretary, are being crowned with success. From the list we have just received of books already presented, we see that almost every department of Government has presented its publications. This remark also applies to the following scientific societies:—The University of Oxford, the Trustees of the British Museum, the Astronomer Royal, the Royal Geographical Society, the Royal Society of Edinburgh, the Botanical Society of Edinburgh, the Early English Text Society, the Historic Society of Lancashire and Cheshire, the Meteorological Society, the Radcliffe Observatory, Oxford, the Royal United Service Institution, the Philosophical Society of Glasgow, the Royal Institution of Great Britain, and Owens College, Manchester. In this list we may remark that some of the most important of our societies are still conspicuous by their absence.

THE problem, "What to do with our juvenile criminals," appears to have been solved by the Government of the State of New York in a most satisfactory manner. We have before us, and hope to be able to return to it again, a pamphlet issued by the "Department of Public Charities and Correction," bearing the title, inexplicable to English bumbledom, of "Cruise of School-ship *Mercury* in Tropical Atlantic Ocean." It is, in fact, an account of a cruise undertaken in the interests of science,

and under the management of Prof. Henry Draper, containing a report "on the chemical and physical facts collected from the Deep Sea Researches made during the voyage of the nautical school-ship *Mercury*, undertaken in the Tropical Atlantic and Caribbean Sea in 1870-71; the "cruisers" being, not Dr. Carpenter, Prof. Wyville Thomson, and Mr. Gwyn Jeffreys, but the boys committed to the care of the Commissioners in New York for slight misdemeanours and vagrancy!

WE regret to hear that the Geology Class at Christ's Hospital, having gone through an introductory course of lectures, has stopped, and has not been replaced by a class of Botany or any sister science. It is greatly to be regretted that the Chemistry Class do not get beyond the simpler metals and easy testing; those who would wish to study Chemistry are restricted to the more elementary branches of inorganic chemistry alone.

PROF. HUGHES, F.R.G.S., gave two lectures at Christ's Hospital on February 3 and 10 on Physical Geography. In his introduction he, like Prof. Huxley, claimed for his science a position equal to that held by the German Erdkunde, defining both to be that which explained to us "the aspect of nature and natural phenomena." In his first lecture he dealt with "High Lands and Table Lands," somewhat overthrowing the popular idea of mountains gained from text books. In his second lecture he spoke of the "Ocean and Deep-Sea Currents," explaining clearly and advocating warmly the ingenious theories and proofs of Dr. Carpenter, about which there has been so much discussion in the pages of NATURE. We attach no little importance to these lectures, because they brought the hearers up to the present state of our knowledge of the deep sea and of the Himalayan Mountains, far further than the best text-books have yet brought us. It is only to be regretted that other gentlemen of like abilities and knowledge with Prof. Hughes do not come forward and offer to lecture to boys on other branches of Natural Science. It is hard for those who feel an interest in nature to feel themselves bound by the iron chains of verse composition.

Lippincott's Magazine for January contains an interesting and profusely-illustrated article on the New Port Storm Signals, by Prof. Thompson B. Maury.

PHYSICS

Preliminary Catalogue of the Bright Lines in the Spectrum of the Chromosphere*

THE following list contains the bright lines which have been observed by the writer in the spectrum of the chromosphere within the past four weeks. It includes, however, only those which have been seen twice at least; a number observed on one occasion (Sept. 7) still await verification.

The spectroscope employed is the same described in the Journal of the Franklin Institute for November 1870; but certain important modifications have since been effected in the instrument. The telescope and collimator have each a focal length of nearly 10 inches, and an aperture of $\frac{7}{8}$ of an inch. The prism-train consists of five prisms (with refracting angles of 55°) and two half-prisms. The light is sent twice through the whole series by means of a prism of total reflection at the end of the train, so that the dispersive power is that of twelve prisms. The instrument distinctly divides the strong iron line at 1961 of Kirchhoff's scale, and separates B (not b) into its three components. Of course it easily shows everything that appears on the spectrum maps of Kirchhoff and Angström. The adjustment for "the position of minimum deviation" is automatic; *i.e.*, the different portions of the spectrum are brought to the centre of the field of view by a movement which at the same time also adjusts the prisms.

* Reprinted from the *American Journal of Science and Arts.*

The telescope to which the spectroscope is attached is the new equatorial recently mounted in the observatory of the College by Alvan Clark and Sons. It is a very perfect specimen of the admirable optical workmanship of this celebrated firm, and has an aperture of $9\frac{4}{10}$ inches, with a focal length of 12 feet.

In the table the first column contains simply the reference number. An asterisk denotes that the line affected by it has no well-marked corresponding dark line in the ordinary solar spectrum.

The second column gives the position of the line upon the scale of Kirchhoff's map—determined by direct comparison with the map at the time of observation. In some cases an interrogation mark is appended, which signifies not that the existence of the line is doubtful, but only that its precise place could not be determined, either because it fell in a shading of fine lines, or because it could not be decided in the case of some close double lines which of the two components was the bright one; or, finally, because there were no well-marked dark lines near enough to furnish the basis of reference for a perfectly accurate determination.

The third column gives the position of the line upon Angström's normal atlas of the solar spectrum. In this column an occasional interrogation mark denotes that there is some doubt as to the precise point of Angström's scale corresponding to Kirchhoff's. There is considerable difference between the two maps, owing to the omission of many faint lines by Angström, and the want of the fine gradations of shading observed by Kirchhoff, which renders the co-ordination of the two scales sometimes difficult, and makes the atlas of Kirchhoff far superior to the other for use in the observatory.

The numbers in the fourth column are intended to denote the percentage of frequency with which the corresponding lines are visible in my instrument. They are to be regarded as only roughly approximative; it would of course require a much longer period of observation to furnish results of this kind worthy of much confidence.

In the fifth column the numbers denote the relative brilliance of the lines on a scale where 100 is the brightest and 1 the faintest. These numbers also, like those in the preceding column, are entitled to very little weight.

Ref. No.	Kirchhoff.	Angstrom.	Relative Frequency.	Relative Brightness.	Chemical Element.	Previous Observer.
1	534·5	7060·?	60	3		
2	654·5	6677·?	8	4		L.
3	C	6561 8	100	100	H.	L. J.
4	719·0	6495·7	2	2	Ba.	
5	734·0	6454·5	2	3		
6	743·?	6431.	2	2		
7	768·?	6370·	2	2		
8	816·8	6260·3	1	1	Ti.	
9	820·0	6253·2	1	2	Fe.	
10	874·2	6140·5	6	8	Ba.	L.
11	D_1	5894·8	10	10	Na.	L.
12	D_2	5889·0	10	10	Na.	L.
*13	1017·0	5871·	100	75		L. J.
14	1274·3	5534·0	6	8	Ba.	R. L.
15	1281·5	5526·0	1	1	Fe.	
16	1343·5	5454·5	1	2	Fe.	
17	1351·3	5445·9	1	2	Fe. Ti.	
18	1363·1	5433·0	1	1	Fe.	
*19	1366·0	5430·0	2	3		
20	1372·0	5424·5	3	4	Ba.	L.
21	1378·5 ?	5418·0 ?	1	2	Ti. ?	
*22	1382·5	5412·	1	1		
23	1391·2	5403·0	2	2	Fe. Ti.	
24	1397·8	5396·2	1	2	Fe.	
25	1421·5	5370·4	1	2	Fe.	R.
26	1431·3	5360·6	2	2		R.?
27	1454·7	5332·0	2	2	Ti.	
28	1462·9	5327·7	1	3	Fe.	
29	1463·4	5327·2	1	3	Fe.	
30	1465·0 ?	5321·	2	2		
31	Corona line 1474·1	5315·9	75	15	Fe?	L.

Ref. No.	Kirchhoff.	Angström.	Relative	Relative Brightness	Chemical Element.	Previous Observer.
32	1505·5	5283·	5	4		
33	1515 5	5275·0	7	5		L. R.
34	E_1	5269·5	1	3	Fe. Ca.	
35	E_2	5268·5	1	2	Fe.	
36	1528·0	5265·5	3	2	Fe. Co.	L.
37	1561·0	5239·0	1	1	Fe.	
38	1564·1	5236·2	1	1		
39	1567·7	5233·5	2	2	Mn.	R.
40	1569·7	5232·0	1	2	Fe.	
41	1577·3	5226·0	1	2	Fe.	
42	1580·5 ?	5224·5	1	1	Ti.	
43	1601·5	5207·3	3	3	Cr. Fe. ?	
44	1604·4	5205·3	3	3	Cr.	
45	1606·5	5203·7	3	3	Cr. Fe. ?	
46	1609·3	5201·6	1	2	Fe.	
47	1611.5	5199·5	1	1		
48	1615·6	5197·0	3	2		L. R.
49	b_1	5183·0	15	15	Mg.	L.
50	b_2	5172·0	15	15	Mg.	L.
51	b_3	5168·5	12	10	Ni.	L.
52	b_4	5166·5	10	10	Mg.	L.
53	1673·9	5153·2	1	1	Na.	
54	1678·0	5150·1	1	2	Fe.	
55	1778·5	5077·8	1	1	Fe.	
56	1866·8	5017·5	2	3		R.
57	1870·3	5015·?	2	2		R.
58	1989·5	4933·4	8	5	Ba.	L.
59	2001·5	4923·2	5	3	Fe.	R. L.
60	2003·2	4921·3	1	1		
61	2007·1	4918·1	3	3		L.
62	2031·0	4899·3	6	4	Ba.	L.
63	2051·5	4882·5	2	2		L.
64	F.	4860·6	100	75	H.	J. L.
65	2358·5	4629·0	1	1	Ti.	
66	2419·3	4583·5	1	1		
67	2435·5	4571·4	1	1	Li.	
68	2444·0	4564·6	1	1		
69	2446·6	4563·1	1	2	Ti.	
70	2457·8	4555·0	1	1	Ti.	
71	2461·2	4553·3	3	3	Ba.	
72	2467·7	4548·7	1	3	Ti.	
73	2486·8	4535·2	1	1	Ti. Ca. ?	
74	2489·5	4533·2	1	1	Fe.	
75	2490·6	4531·7	1	1	Ti.	
76	2502·5	4524·2	2	2	Ba.	
77	2505·8	4522·1	1	2	Ti.	
78	2537·3	4500·4	1	3	Ti.	
79	2553·?	4491·0 ?	1	1	Mn. ?	
80	2555·?	4489·5 ?	1	1	Mn. ?	
81	2566·5	4480·4	1	2	Mg.	L.
82	2581·5 ?	4471·4	75	8	A band rather than a line.	
83	2585·5	4468·6	1	1	Ti.	
84	2625·0	4443·0	1	1	Ti.	
85	2670·0	4414·6	1	1	Fe. Mn.	
86	2686·7	4404·3	1	2	Fe.	
87	2705·0	4393·5	3	2	Ti.	
88	2719·?	4384·8	1	1	Ca. ?	
89	2721·2	4382·7	1	2	Fe.	
90	2734·?	4372·	1	1		
91	2737·?	4369·3 ?	1	1	Cr.	
92	2775 8	4352·0	1	1	Fe. Cr.	
93	2796·0	4340·0	100	50	H.	L. J.
94	G.	4307·0	1	2	Fe. Ti. Ca.	
95	2870·0	4300·0	1	1	Ti.	
96		4297·5	1	1	Ti. Ca.	
97		4289·0	1	2	Cr.	
98		4274·5	1	2	Cr.	
99		4260·0	1	1	Fe.	
100		4245·2	1	1	Fe.	
101		4226·5	1	1	Ca.	
102		4215·5	1	2	Fe. Ca.	
103	*h.*	4101·2	100	20	H.	R. L.

The sixth column contains the symbols of the chemical substances to which, according to the maps above referred to, the lines owe their origin.

There are no disagreements between the two authorities; in a majority of cases, however, Angström alone indicates the element, and there are several instances where the lines of more than one substance coincide with each other and with a line of the solar spectrum so closely as to make it impossible to decide between them.

In the seventh and last column the letters J., L., and R. denote that to my knowledge the line indicated has been observed and its place published by Janssen, Lockyer, or Rayet. It is altogether probable that a large portion of the other lines contained in the catalogue have before this been seen and located by one or the other of these keen and active observers, but if so I have as yet seen no account of such determinations.

I would call especial attention to the lines numbered 1 and 82 in the catalogue; they are very persistently present, though faint, and can be distinctly seen in the spectroscope to belong to the chromosphere as such, not being due, like most of the other lines, to the exceptional elevation of matter to heights where it does not properly belong. It would seem very probable that both these lines are due to the same substance which causes the D^3 line.

I do not know that the presence of titanium vapour in the prominences and chromosphere has before been ascertained. It comes out very clearly from the catalogue, as no less than 20 of the whole 103 lines are due to this metal.

Hanover, N.H., Sept 13, 1871 C. A. YOUNG

SCIENTIFIC SERIALS

THE *American Naturalist* for October 1871 commences with a paper by Dr. Jeffreys Wyman entitled, "Experiments with Vibrating Cilia," the chief points in which are some determinations of the rate of movement of the vibrating cilia on the gills of Mollusca, both in air and in water, and the description and drawing of an instrument by means of which this rapidity can be measured and exhibited so as to be seen over a large lecture-room. Prof. James Orton furnishes some contributions to the Natural History of the Valley of Quito (continued in the next number); and Dr. J. S. Billings contributes a paper on *Hysterium*, a genus of Ascomycetous Fungi, and some of its allies, illustrated by a plate. Mr. T. Martin Trippe has a very interesting paper on some differences between Eastern and Western Birds, in which he traces the difference in habits, note, time of breeding, &c., in the same species of bird in the eastern and newly-settled western portions of the American continent, and the manner in which the indigenous avifauna of the Western States is becoming gradually superseded by eastern forms, along with the advance of man.

The first paper in the number for November is by Grace Anna Lewis on Symmetrical Figures in Birds' Feathers, in illustration of the beauties furnished for the microscope by the feathers of birds. Dr. Elliott Coues gives a description and drawing of a little-known species of oriole, the only one which is a native of the Western States, and is known as Bullock's Oriole, *Xanthorthus Bullockii*, Swainson. Prof. George H. Perkins contributes some "Notes on the Geodes of Illinois;" and the remainder of the number is occupied by reviews, and the usual interesting items of Natural History Miscellany.

The number for December opens with an extremely interesting paper by the Editors on "The Mammoth Cave and its Inhabitants," an account of a visit paid to this extraordinary cavern in a hill of the sub-carboniferous limestone formation in Edmondson County, Kentucky, after the Indianapolis meeting of the American Association for the Advancement of Science. After a general description of the cave and history of its inhabitants, it contains a description, with drawings, of all the species of Crustacea and insects which are found in it. The Rev. Samuel Lockwood writes an account of "A Singing *Hesperomys* or Vespermouse," the species known as the jumping-mouse, wood-mouse, and white-footed mouse, with the notes of its song. This number concludes Vol. v. of this admirably-conducted magazine, which we commend to the notice of all interested in the study of natural history.

Journal of Botany for January. A memoir of the late lamented editor of this journal, Dr. Berthold Seemann, commences the new

volume, now conducted by Dr. Trimen, assisted by Mr. J. G. Baker. The original articles are as follows:—"On the Genus *Albizzia*, nearly allied to *Acacia*," by Baron Ferd. von Mueller; "The *Erysiphei* of the United States," by Messrs. M. C. Cooke and Peck; a continuation of Mr. J. G. Baker's "Botany of the Lizard Peninsula;" and Lichenographical Notes, by J. A. Martindale. Short notes, reviews, and reprints, complete the programme of the number.

THE first article in the *Quarterly Journal of Science* for January is by Captain S. P. Oliver, on "The Dolmen Mounds and Amorpholithic Monuments of Brittany," in which he details the history and analogies of these mounds, classifying them into twelve distinct varieties. The article is apparently not complete. Next follows a short paper on "The Illumination of Beacons and Buoys," detailing the most recent inventions in this direction. The third article is on "Natural and Artificial Flight," detailing M. Marey's investigations on this subject, with numerous illustrative woodcuts. A paper on "The Coal Commissioners' Report" is simply a *résumé* of the evidence brought before the Commission. Mr. Mungo Ponton, on "The Spectroscope: its Imperfections and their Remedy," advocates the construction of an instrument on the diffracting principle, without which the writer maintains that accuracy, certainty, and uniformity of results cannot be attained. The last and longest article in the number is on "Modern Cannon Powder," with two steel plates. A larger proportion than usual of this number is occupied by notices of books, and details of the progress of the physical and mechanical sciences.

THE last published part of the "Memoirs of the Natural History Society of Danzig" ("Schriften der Naturforschenden Gesellschaft in Danzig," New Series, vol. ii., Heft 3 and 4) contains but few papers of general interest, although the special scientific importance of some of them is doubtless very great. Thus a great part of it is occupied by a number of tables giving the results of meteorological observations made in Danzig, with great care and astonishing labour, by M. F. Strehlke, during the years 1841–43, and by a series of tables of refraction for micrometers, by M. E. Kayser. Two other papers of almost purely local interest relate to the chemical composition of the water supplied to Danzig, and to its effects upon lead pipes. The preceding papers occupy more than half the number before us; the remainder all relate to natural history matters. M. C. G. H. Brischke continues his minor observations upon insects, the greater part of his present communication relating to the enemies of the rape-plant and their parasites. The dipterologist will find a new species of *Phytomyza* described under this head. The same author contributes a list of the Rhynchota of the Province of Prussia. The fourth section of M. A. Menge's Prussian Spiders completes the list of zoological contributions. In it the author describes the first two families of his third tribe (the Tubitelæ), ending with *Argyroneta aquatica*, as the 170th species here described by him. M. A. Ohlert's "Lichenological Aphorisms," the only botanical paper, contains some important and interesting observations.

THE following are the most important articles in the *Revue Scientifique*, Nos. 25—32. Prof. Lorain, of Paris, has an interesting article on the report of the Committee of 1870 on the liberty of higher instruction; Mr. Herbert Spencer contributes a paper on General Laws; report of M. Quatrefage's course of lectures on Anthropology at the Museum of Natural History; Helmholtz's address in memory of Prof. Magnus at the Academy of Sciences at Berlin; Herbert Spencer on the Classification of the Sciences, an elaboration of his essay "On the Genesis of Science," published in 1854; Berthelot on the state of bodies in solution; report of Prof. Bernard's course of lectures at the College of France on Experimental Medicine; abstracts of paper read at the Indianopolis Meeting of the American Association for the Advancement of Science; translations of Lockyer's, Maclear's, and Respighi's accounts of the Total Solar Eclipse, together with reports of M. Janssen's observations; an article by Herbert Spencer on the reasons why he dissents from the philosophy of Comte, being a reply to a review in the *Révue des Deux Mondes;* M. Verneuil on Surgical Pathology; report of the committee appointed by the Society of Physicians and Surgeons of the Paris Hospitals to visit the new Hôtel Dieu; M. Alglave on the scientific *réunions* at the Assembly; M. Hebert on the "Tithonic Stage," and the new German school. There are in addition a number of reports of proceedings of foreign societies.

SOCIETIES AND ACADEMIES

LONDON

Royal Institution, February 5.—Sir Frederick Pollock, Bart. vice-president, in the chair. Messrs. Alexander Brodie, John Cleghorn, Edward John Gayer, Arthur Edward Griffiths, William Grogan, the Hon. Frederick H. North, Messrs. Samuel Wagstaff Smith, W. Soames, Henry Virtue Tebbs, Burney Yeo, Henry Yool, were elected members. The special thanks of the members were returned for the following donations to "The Fund for the Promotion of Experimental Researches:"—Prof. Tyndall (3rd donation) 30*l*., Mr. Arthur Giles Puller (5th donation) 21*l*. The presents received since the last meeting were laid on the table, and the thanks of the members returned for the same.

Geologists' Association.—A special general meeting was held on the 2nd February, when a revised code of laws was adopted. Subsequently, at the annual meeting, the report for 1871 was adopted, and the officers for the ensuing year elected. At the ordinary meeting which followed, the Rev. J. Wiltshire, M.A., F.G.S., president, in the chair, a paper was read by the Rev. T. G. Bonney, M.A., F.G.S., tutor of St. John's College, Cambridge, "On the Chloritic marl, or Upper Greensand, of the neighbourhood of Cambridge." The author commenced by a brief sketch of the geology of the Cam valley, and the position of the seam, barely a foot in thickness, which rests upon the eroded surface of the Gault, and is full of green grains and dark nodules, rich in phosphate of lime. He described the matrix as a fine chalky marl, full of foraminifera, and minute fragments of organisms, with a considerable mixture of mud, insoluble in hydrochloric acid. The composition of the green grains (commonly called glauconite) was then discussed, and it was shown that they differed considerably from the typical mineral of that name; he had not satisfied himself that any were casts of foraminifera. After a few words on the phosphatic nodules, and some erratic rocks in the bed, he gave a sketch of the palæontology of the deposit, calling attention to the condition of the various fossil remains, and to the number and size of the pterodactyles and turtles. He then gave his reasons for considering this deposit as formed during the Upper Greensand epoch, but as containing many fossils which had been derived from the Upper Gault by slow denudation. The nodules he considered as mainly of concretionary origin; for they were too pure to be regarded as clay saturated by phosphate. He concluded by sketching out his conception of the physical geography of the East Anglian district in the Neocomian and lower part of the Cretaceous epoch.—Prof. Morris, after some remarks on the value of the paper, spoke of the composition of the green grains, and then traced the range of the deposit, which he agreed with Mr. Bonney in thinking was the formation of a very long period of time.—Mr. Lobley remarked upon the mineralogical and palæontological differences existing between the Cambridge deposit and the chloritic marl of Dorsetshire.—Mr. Bonney, in his reply, having referred to the great scarcity of fossils in the Gault of Cambridge, the Rev. T. Wiltshire stated that the Gault of Kent was in some places devoid of organisms.

Zoological Society, February 6.—Mr. R. Hudson, F.R.S. V.P., in the chair.—A communication was read from Dr. J. S. Bowerbank, F.R.S., containing the first portion of a series of papers, entitled "Contributions to a general History of the Spongiadæ," in which descriptions were given of several species of *Tethea*, and of *Halispongia choanoides*.—A communication was read from Dr. John Anderson, containing notes on a young living female of *Rhinoceros sumatrensis*, which had been captured in Chittagong, in February 1868, and had been removed to Calcutta on its way to England. These notes were accompanied by a photograph of the animal from life.—A second communication from Dr. Anderson contained notes on *Manouria* and *Scapia*, two supposed genera of Land-Tortoises, which Dr. Anderson showed to be identical with *Testudo emys* of Schlegel and Müller.—Mr. Sclater read a paper on Kaup's Cassowary (*Casuarius Kaupi*), of which the Society's collection contained a living specimen. To this was added a list of the other known species of the genus *Casuarius*, and an account of their geographical distribution.—A communication was read from Dr. A. Günther, F.R.S., on two specimens of Lizards of the genus *Hydrosaurus*, from the Philippine Islands, for one of which, being hitherto undescribed, Dr. Günther proposed the name *Hydrosaurus nuchalis*.—A second communication from Dr. A. Günther contained the

description of a new genus and species of Characinoid Fishes from Demerara, proposed to be called *Nannostomus beckfordi*.—A communication was read from Lieutenant Reginald Beavan, of the Revenue Survey Department of India, containing descriptions of two new species of Cyprinoid Fishes from the Punjab.—Mr. Howard Saunders exhibited specimens of and described a new species of Green Woodpecker from Southern Spain, which he proposed to call *Gecinus sharpii*.

Anthropological Institute, February 5.—Dr. Charnock, vice-president, in the chair. W. J. Jeaffreson, M.A., was elected a member.—Lieut.-Col. G. G. Francis exhibited a series of flint, stone, and bone implements and human bones from Paviland, Gower.—Mr. George Harris, vice-president, read a paper "On the hereditary transmission of endowments and qualities of various kinds." Of the actual transmission of qualities no doubt could be entertained. Many thought they were mainly derived from the mother, and in some instances they were inherited from the grandparents. That was often observed in cases of disease. Endowments did not, however, always directly descend, but were transmitted in various ways, such as in the descent of particular talents. In other cases it was modified in the transmission; occasionally the various qualities of both parents seemed to be divided among the different members of the family. That was observable in the breeding of animals. Physical qualities were also transmitted in the same way, and artificial acquirements had been considered transmissible. The most extraordinary instances were related of the existence of complete continuity, both mental and moral, between the parents and the children. The author considered the subject to be one of deep interest, and suggestive of various theories, and irespecting which the observations of each might add to the common stock of knowledge.—A paper on "the Wallons," by Dr. Charnock and Dr. Carter Blake, was then read. The Wallons were descendants of the old Gallic Belgæ who held their ground in the Ardennes, when Gaul was overrun by the Germans. The Wallons were tall, somewhat slender, raw-boned, tough, rough, and hardy, and made excellent soldiers. Their hair was dark, eyes fiery, dark-brown, or blue, and deep sunk. The ordinary Wallons stood in a similar relation to Belgium to what the Irish peasant did to the Sassenach. They were poor, jovial, good-natured, superstitious, chaste, hospitable, quarrelsome, violent, and generous, like the Irish. They were poetical, rich in song, and fond of the dance. They surpassed the Flemish in adroitness, activity, and skill, and the French in earnestness, perseverance, and diligence. As evidence of their peculiar character, a Wallon would drag a pig from Namur to Ghent, or even to Bruges, to gain a few sous more than he could in his own district. Some of the most eminent of the modern statesmen of Belgium were of Wallon descent. Notwithstanding these general remarks, a special mental and moral character might be predicated of the Wallons of each district. The paper concluded with copious remarks on the language of the Wallons, together with their proverbs.

Society of Biblical Archæology, February 6.—Dr. Birch, president, in the chair.—The following gentlemen were duly proposed as members of the society:—Mr. T. H. Christy, Mr. James Collins, Mr. George C. Hale, Rev. Prof. Mahaffey. An important communication was received from M. Clermont Ganneau, on an "Inscription in Hebrew or Ancient Phœnician Characters of the time of the Kings of Judah, discovered at Siloam-el-Fokani, near Jerusalem." In this paper M. Ganneau related the discovery of two incised tablets, executed on the wall of a ruined rock-cut chamber or sacellum, near to the house of the Sheikh of Siloam. The inscriptions were in the old Archaic character, now familiar to the archæological world in the famous Moabite Stone. Some Christian hermit had, about the fourth century of our era, wilfully mutilated part of the writing, but enough still remained to attest its extreme value as a palæographic record. Portions of the first four lines of the first tablet the learned savant believed to contain the name of the divinity Baal, and to denote a votive dedication to him by a functionary, name illegible, about the period of the later Kings of Judah. The author inclined to think that the cave had been originally dedicated to Baal at a still earlier period, probably by one of Solomon's Moabitish wives, and that it was afterwards added to and finished in a subsequent reign. M. Ganneau promised, in conclusion, shortly to lay before the society a more perfect examination and conjectural restoration of the inscriptions on both tablets, and expressed a hope that the records in question would prove not inferior in importance to any other, as being themselves the oldest, or nearly the oldest, positively Hebrew inscriptions in existence.

Mathematical Society, February 8.—Prof. Cayley, vice-president, in the chair. The chairman mentioned that the president had made inquiries at the Home Office as to the mode of procedure requisite for obtaining a charter for the society, and that the matter would come on for consideration at the next subsequent meeting (March 14) when members would have an opportunity of stating their views upon the desirability of incorporation.—Mr. J. W. L. Glaisher was elected a member of the society.—Mr. Cotterill gave an account of his paper "On an Algebraical Form, and the geometry of its dual connection with a polygon, plane, or spherical." The chairman, Dr. Hirst, and Prof. Clifford took part in a discussion on the paper.

Entomological Society, February 5.—Prof. Westwood, president, in the chair.—Mr. McLachlan brought before the notice of the meeting an illustration of the manner in which the increase of plant-lice is checked by Hymenopterous parasites; a family of aphides collected round a poplar twig exhibited had been utterly destroyed by these parasites, there remaining only the inflated empty skins much resembling the egg of some large insect, and each with a circular hole whence the parasite had emerged.—Mr. Druce exhibited a selection from a large collection of butterflies formed in Costa Rica by Dr. Van Patten. It included about fifty new species and one new genus. Amongst the more striking forms were four new species of *Papilio*, three of *Morpho*, three or four of *Leptalis*, &c.—Prof. Westwood exhibited drawings and specimens of various interesting species of *Acarnia*, including forms new to Britain. One of these was allied to the poisonous *Argas persicus*, and had been found in the crypt of Canterbury Cathedral. Mr. Bond had also seen examples found in a church on a gentleman's coat after two young bats had fallen upon him from the roof. Another pertained to the genus *Trogulus*, and had been found in Dorsetshire.—Major Parry read a paper on new species of Leucanoid *Coleoptera*, which was followed by others by Prof. Westwood and M. Snellen van Sollenhoven, on insects of the same family.

EDINBURGH

Royal Physical Society, January 25.—Dr. Robert Brown, president, in the chair.—Prof. Turner exhibited a large specimen of the electrical eel *(Gymnotus electricus)* of South America, which he had received a few weeks ago from Dr. Ridpath, surgeon, West India Mail Steam Packet Service. He described the arrangement of the electrical organs, and compared them with the corresponding organs in *Torpedo*, *Malapterurus*, and *Mormyrus*, and in the tail of the common skate. Dr. T. Strethill Wright made some remarks on the relation of these curious organs to various electrical apparatus. The organs of the electrical fishes were not properly batteries, but were probably condensing apparatus. Some time ago he made an artificial electrical eel, and with it he had performed all the experiments Prof. Faraday had done with the electrical eel itself, which he would exhibit and explain to the society. He gave a sketch on the board of condensing voltaic apparatus, which was probably analogous to that of the electrical fishes.—Various species of Pedunculated Cirripedes of Barnacles were exhibited from Shetland, Cornwall, the Black Sea, &c., by Mr. C. W. Peach. In October last Mr. Gatherer, of Lerwick, sent him a fine colony of *Lepas fascicularis* which had been taken floating off Kirkallister lighthouse by a gentleman fishing, and who saw a great many similar masses floating past his boat. They are each attached to a bulb like mass, and are in various stages of growth. About ten are left, some having fallen off. When very young they are attached by a short peduncle to feathers, cork, cinders, and seaweeds, or any other floating object. As they increase in size they form a bulb on the foot-stalk. This in time becomes so large that it falls off, and thus the animal is buoyed up with it—in fact, "paddles its own canoe." When thus afloat the animals multiply, and the bulb is enlarged also. It is far from rare, and found in all seas. In Cornwall, after long-continued south-west winds, it is thrown ashore by thousands.—"Remarks on the Diamond Fields of South Africa," by Mr. Andrew Taylor.

DUBLIN

Royal Geological Society of Ireland, January 10.—Dr. W. Frazer in the chair. Prof. E. Hull, F.R.S., read some notes on the Marble of Carrara.—Prof. Macalister read

notes of some further "Researches on Conchospirals." He pointed out the geometrical properties of the logarithmic spirals of Mollusca, the special form of spiral in Ammonites, and the methods of deducing the individual specific parameters from (α) tangential measurements, (β) horizontal sections, and (γ) vertical sections.—The Chairman exhibited a human skull from Swan River, Australia, encrusted with shells and much acted on by water.

PARIS

Academy of Sciences, February 5.—M. Serret presented a note by M. A. Mannheim, containing generalisations of Meunier's theorem.—M. H. Resal presented a memoir on the mechanical effects of the American hammer.—A memoir was read by M. E. Duclaux on the laws of the flow of liquids in capillary spaces.—Mr. P. Blaserna presented a note on the solar atmosphere, in which he claims to have arrived at the same conclusions with M. Janssen, from his observations during the eclipse of December 22, 1870.—M. Renou replied to the observations made by M. Delaunay with regard to the Meteorological Annual of the Paris Observatory at the last meeting of the Society, and M. Le Verrier suggested the appointment of a committee to revise the meteorological observations presented to the Academy during the last century, and to bring out an authentic edition of them.—Communications, descriptive of the aurora observed in France and elsewhere on the evening of February 4, from MM. Frou, Salicis, Laussedat, and Chapelas, were read, as also an extract from a letter from M. Cornu to M. Fizeau upon the spectrum of the same aurora. The most important result obtained by the last-mentioned author was the determination of the existence of a yellowish-green band coinciding with that previously observed by Angström in 1867-68.—M. Prazmowski also presented a note on the spectral investigation of the aurora of Feb. 4. He described a green band about E of Fraunhofer (seemingly identical with that observed by M. Cornu), a red band near C, and two more very faint bands in the blue and violet, near F and G.—M. Bobierre communicated some chemical investigations on the Landes of Brittany, in which he noticed especially the constituents of the ashes of plants grown on those soils. They are chiefly remarkable for the great quantity of silica contained in them and their poverty in alkaline salts.—M. Cahours presented a note by M. G. Chancel, on the contraction of solutions of cane sugar at the moment of inversion, and on a new saccharimetric process. The author described the method employed by him, and stated that a solution of cane sugar, after inversion, has undergone an appreciable diminution of volume, which increases in proportion to the amount of sugar in solution. Upon this property he proposes to found a new method of saccharimetry.—M. Sacc presented an analysis of the linseed oil referred to in a recent memoir read to the Academy.—M. Dupuy de Lome read two long and exceedingly interesting papers upon the construction of a screw aerostat invented by him, and on the results of a trial trip made with it. The machine consists of an oblong balloon, with a boat-shaped car; the author describes it as presenting great stability. The propeller worked by eight men moved the balloon through the air with a velocity of 2·82 metres per second, or 10¼ kilometres (about 6¼ miles) per hour, so that a certain amount of power over the movements of the machine was obtained.—The warm discussion upon heterogeny and the nature of fermentation was continued at this meeting by a second communication on the latter subject by M. Fremy, who denies that the experiments of M. Pasteur have anything to do with fermentation. He also declared that his theory has nothing in common with that of Liebig, with which it was identified by M. Wurtz. The paper contained accounts of experiments made with malt, yeast, milk, and grape-wort, and upon the decomposition of organic bodies by the action of moulds.—MM. Dumas and Balard made some remarks on this communication, and M. V. Meunier presented a note in which he stated that organic bodies do frequently make their appearance in solutions treated after M. Pasteur's method, so that, he thought, the results obtained by that gentleman are not conclusive.—M. de Quatrefages presented a note by M. E. T. Hamy describing the occurrence of brachycephalous negroes among the Cammas on the shores of the Fernand-Vaz River in Western Africa.—M. Milne-Edwards described a self-regulating gas-heating apparatus in use in the zoological laboratory of the Museum; and M. Sichel *fils* forwarded the description of a new ophthalmoscope for simultaneous observations by two persons.

BOOKS RECEIVED

ENGLISH.—A Treatise on Attractions, Laplace's Functions, and the Figure of the Earth, 4th edition: J. H. Pratt (Macmillan and Co.)—Science and Humanity: Noah Porter (Hodder and Stoughton).—Solid Geometry and Conic Sections: J. M. Wilson (Macmillan and Co.)—Report by the Committee on Intemperance, for the Lower House of Convocation: (Jas. Clarke and Co.)—Our National Resources and how they are reached: W. Hoyle (Simpkin and Marshall).—Consumption, and the Breath re-breathed; Dr. H. M'Cormac (Longmans).

FOREIGN.—Bulletin de la Société Imperiale des Naturalistes de Moscou, 1871, Nos. 1 and 2.

DIARY

THURSDAY, FEBRUARY 15.

ROYAL SOCIETY, at 8.30.—On the Induction of Electric Currents in an Infinite Plane Conducting Sheet: Prof. Clerk Maxwell, F.R.S.—On some Derivatives of Uramido-benzoic Acid: J. P. Griess, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.

LINNEAN SOCIETY, at 8.—On a Chinese Artichoke Gall: A. Müller, F.L.S.—On the Habits, Structure, &c., of the Three-banded Armadillo: Dr. J. Murie, F.L.S.—Comparative Geographical Distribution of Butterflies and Birds: W. F. Kirby.

CHEMICAL SOCIETY, at 8.

FRIDAY, FEBRUARY 16.

ROYAL INSTITUTION, at 3.—On the Crystallisation of Silver and other Metals; Dr. Gladstone, F.R.S.

GEOLOGICAL SOCIETY, at 1.—Anniversary Meeting.

SATURDAY, FEBRUARY 17.

ROYAL INSTITUTION, at 3.—On the Theatre in Shakespeare's Time: Wm. B. Donne.

SUNDAY, FEBRUARY 18.

SUNDAY LECTURE SOCIETY, at 4.—On the Human Hand, as Illustrating the Scheme of Creation: Lawson Tait.

MONDAY, FEBRUARY 19.

ENTOMOLOGICAL SOCIETY, at 7.

ANTHROPOLOGICAL INSTITUTE, at 8.—Strictures on Darwinism: H. H. Howorth.—Race-Characteristics as related to Civilisation: J. Gould Avery.

LONDON INSTITUTION, at 4.—Elementary Chemistry: Prof. Odling, F.R.S.

TUESDAY, FEBRUARY 20.

ROYAL INSTITUTION, at 3.—On the Circulatory and Nervous Systems: Dr. Rutherford.

ZOOLOGICAL SOCIETY, at 9.—Notes upon the Anatomy of the young Hippopotamus, as observed in the specimen which died in the Society's Gardens on the 10th January, 1872: J. W. Clark.—Contributions to a General History of the Spongiadæ. Part II: Dr. J. S. Bowerbank.—On the Spiders of Palestine and Syria; containing a general list with descriptions of numerous new species and characters of two new genera: Rev. O. P. Cambridge.

STATISTICAL SOCIETY, at 7.45.—On Prison Discipline and Statistics in Lower Bengal: Dr. Mouat.

WEDNESDAY, FEBRUARY 21.

GEOLOGICAL SOCIETY, at 8.—Migrations of the Graptolites: Prof. H. Alleyne Nicholson, F.G.S.—How the Parallel Roads of Glen Roy were Formed: Prof. James Nicol, F.G.S.—Notes on Atolls or Lagoon-islands: S. J. Whitnell.

SOCIETY OF ARTS, at 8.—On Prison Labour, as an Instrument of Punishment, Profit, and Reformation: F. J. Mouat.

ROYAL SOCIETY OF LITERATURE, at 8.30.—On Results of recent Excavations in Rome: Mr. Vaux.

METEOROLOGICAL SOCIETY, at 7.

THURSDAY, FEBRUARY 22.

ROYAL SOCIETY, at 8.30.

ROYAL INSTITUTION, at 3.—On the Chemistry of Alkalies and Alkali Manufacture: Prof. Odling, F.R.S.

SOCIETY OF ANTIQUARIES, 8.30.

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